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THE AEROPLANE

Incorporating
Aeronautical Engineering
Edited by - - THURSTAN JAMES

Founder and First Editor
(1911-1939), C. G. GREY

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EXPANDING THE FIELD

WHEN the editorial was written last week the annual dinner of the Society of British Aircraft Constructors had not taken place. In the intervening seven days the dinner has been held; the new president, Mr. Aubrey Burke, has made his inaugural speech and at the same dinner Sir George Edwards also spoke. No official reports of those speeches are available for the occasion was a private affair. However, both these speakers so forcibly enunciated a general view that it is no secret the speeches were warmly received. No doubt the growing realization that the day of the military aeroplane is likely to be a long one contributed to the feeling that the outlook is less bleak. Equally, until orders are given for the Canberra replacement and the new long-range load-carrying military transport, anxiety will continue.

It is therefore not out of place that this issue of THE AEROPLANE should be devoted to our annual survey of the World's commercial aircraft, both a-building and projected. There are sufficiently many of these to have forced us to discard various regular features in order that the presentation of the mass of specially collected data should not be handicapped. This pressure on our space has meant that we had to postpone our report of the international gliding competitions in Poland and to limit our report of the NATO air display at Liège.

That occasion owed much of its interest to the first appearance in Europe of the Lockheed Starfighter and to the arrival of four Voodoo fighters which flew straight across the Atlantic for the occasion. It was a far cry to the thirty-four hours when a lone American transport pilot made a solo Atlantic crossing in a 220-h.p. monoplane. But there were not only American aeroplanes at the Show.

Besides our own incomparable Hunters of No. 111 Squadron and those of the Royal Belgian Air Force, there was also an example of the French Breguet Alizé, a sub-killer of formidable performance, as became apparent in the description which we published last week. This aeroplane is of special interest to our industry because it is powered with a Rolls-Royce Dart. Another aeroplane in the news is the Fokker Friendship which it seems that Mr. Ansett may well order for use in Australia. Not only does this twin-engined transport aeroplane also have Dart engines but it makes use of many components and accessories fabricated in this country. This point was well brought out in our recent description (THE AEROPLANE, April 11 last). Another item of news, that two Folland Gnat fighters have been sold to Yugoslavia, is further evidence of British aeronautical export achievement. It may not be generally known that a case has been made for evaluating a French light fighter at the same time as the trials of the Gnat are taking place in Aden. We understand that if the French aeroplane were to be approved, a licence to build it in England has already been arranged.

With the thoughts of many people in this country turning towards the forthcoming S.B.A.C. Show at Farnborough it may be salutary to consider for a moment what may be the implication of the various facts set out in this editorial. Overshadowing all else is the fact that the NATO forces on the Continent owe much, and will owe more, to the United States and the tremendous aircraft industry of that great and generous country. In the circumstances it is not surprising to find people in this country who argue that a much better job of competing with the U.S. industry for world trade could be brought about if the aircraft industries of Europe got themselves closer together. A first step in this direction has obviously been achieved with the utilization of British power plants by Continental manufacturers. And it is no longer news that some degree of working together has been achieved by the aircraft industries of France, Italy and Germany.

This growing co-operation of Western European aircraft industries may be studied at the biennial displays at Le Bourget, still nostalgically referred to as the Paris Show. In contrast the great Show at Farnborough is very much a British affair. Incidentally, we gather that this year the R.A.F. participation will be greatly strengthened. But to return to the point, the view that it should be British is so strongly held that neither British aeroplanes powered by foreign engines nor foreign aircraft powered by British engines may be shown; both have to await their turn at the Paris Show.

It must not be overlooked that competition in the international aircraft market is being intensified by the growing participation by Russia and other countries associated with Soviet régime. It seems pointless to refer any more to countries "behind the iron curtain," for there is a steady traffic of observers both ways across the frontiers. Traffic may not be free from control nor from dislocation, but it exists and can only increase as the Russians carry out their expressed determination to compete economically with the West. In such circumstances it seems clear that all methods of making the fullest possible use of Western European aircraft construction facilities will have to be followed up. These things do not happen over night, but the cases we have cited are an example of progress towards a goal.

MATTERS OF MOMENT

Guiding the Industry

MR. AUBREY F. BURKE, O.B.E., chairman and managing director of The de Havilland Aircraft Co., Ltd., has been elected president of the Society of British Aircraft Constructors, Ltd., for 1958-59. He is also chairman of The de Havilland Engine Co., Ltd., deputy chairman of de Havilland Holdings, Ltd., and is on the board of de Havilland Aircraft, Inc. (U.S.A.). He has been a member of the council of the Society since 1946.

The newly elected vice-president of the S.B.A.C. is Sir George Dowty, chairman and managing director of the Dowty Group of companies, chairman of 11 subsidiary companies and a director of Remploy, Ltd., and Mr. C. F. Uwins, O.B.E., A.F.C., who was the Society's president for 1956-58, becomes deputy president. He is deputy chairman of the Bristol Aeroplane Co., Ltd., a director of Bristol Aircraft, Ltd., and of the Bristol Aeroplane Co. (Aust.) Pty., Ltd.

Sir Frederick Handley Page, C.B.E., was re-elected treasurer.

Membership of the S.B.A.C. council for 1958-59 is:—

Ordinary Members: Mr. J. J. Parkes (Alvis); Mr. H. T. Chapman (Armstrong Siddeley); Mr. H. M. Woodhams (Armstrong Whitworth); Mr. F. Bates (Auster); Mr. E. Turner (Blackburn); Mr. J. D. North (Boulton Paul); Mr. C. F. Uwins (Bristol Aircraft); Sir Reginald Verdon Smith (Bristol Aero-Engines); Mr. A. F. Burke (de Havilland Aircraft); Mr. H. L. Buckingham (de Havilland Engines); Sir Ralph Sorley (de Havilland Propellers); Sir George Dowty (Dowty Equipment); Viscount Caldicott (English Electric, Aircraft); Mr. H. G. Nelson (English Electric, Guided Weapons); Mr. G. W. Hall (Fairey); Mr. W. E. W. Petter (Folland); Mr. H. Burroughes (Gloster); Sir Frederick Handley Page (Handley Page); Mr. G. C. D. Russell (Handley Page, Reading); Mr. W. A. Summers (Hunting Aircraft); Mr. H. Sammons (Napier); Sir Roy Dobson (A. V. Roe and Co., Ltd.); Mr. W. T. Gill (Rolls-Royce); Mr. J. D. Pearson (Rolls-Royce); Mr. A. A. Rubbra (Rolls-Royce); Capt. E. D. Clarke (Saro); Mr. B. Boxall (Scottish Aviation); Rear Admiral Sir Matthew Slattery (Short Bros. and Harland); Mr. R. P. H. Yapp (Vickers-Armstrongs, Supermarine); Mr. T. Gammon (Vickers-Armstrongs, Weybridge); Mr. E. C. Wheeldon (Westland).

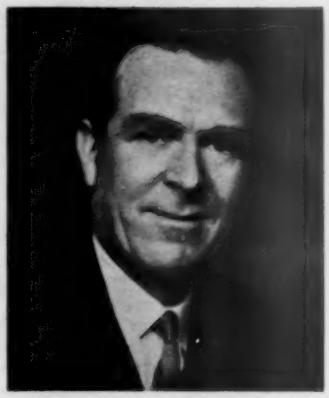
Associate Members: (Materials Group) Mr. H. G. Herrington; Mr. C. E. Holmstrom. **(Equipment Group)** Mr. F. Rowarth; Mr. T. C. L. Westbrook, plus one other to be appointed.

Majority Report

IN February this year the Air Registration Board had completed 21 years of its life—so the annual report for the year of its majority, due to be issued yesterday, has sentimental as well as practical interest.

The main feature of this report concerns the development of U.S.A.-U.K. reciprocal certification arrangements. During the year the Board, with the assistance of the S.B.A.C., had undertaken a line-by-line comparison of British and American requirements—bringing to light some hundreds of differences between the two codes.

A delegation from the Board visited Washington to discuss these with the C.A.A. As a result, the majority of the differences were classified as being of insufficient significance to warrant special treatment (i.e., each country would be prepared to accept the other's as equivalent). This left a residue of differences of such importance that the U.S.A. and the U.K. would impose Special Requirements on each. The Board saw no objection to the embodiment of many of the proposed U.S. requirements,



S.B.A.C. PRESIDENT.—As reported alongside, Mr. A. F. Burke, O.B.E., has been elected president of the Society of British Aircraft Constructors for 1958-59.

and work is now in hand to accomplish this—which will permit a reduction in the U.S.A. list of Special Requirements.

There are a few problem areas where neither the A.R.B. nor the C.A.A. is sufficiently certain of the appropriate requirements to reach conclusions, and these will need to be examined in relation to each type of aircraft.

The subject of performance requirements has been dealt with as a separate issue since, until recently, the U.S.A. and British requirements were of fundamentally different form. However, in February, 1957, the C.A.B. held a special hearing, at which the staff of the A.R.B. were present, and it was then decided that for turbine-engined aeroplanes the U.S.A. would radically recast their requirements—the new form being close to the British method.

The new U.S.A. requirements appeared in July, 1957, and in December a U.K. delegation met representatives of the U.S.A. At this meeting it became quite clear that there was a very good prospect of obtaining substantial uniformity of the two performance codes. Since that meeting the U.S.A. has proposed another revision of their performance code and has introduced changes which further reduce the differences; these proposals have been discussed with a U.S.A. delegation which visited London in April. The Board has held several meetings of its Flight Requirements Committee with the object of revising British requirements in a direction which minimizes differences with the U.S.A.

The Board has devoted a small proportion of its effort to consideration of airworthiness requirements for possible future types of aircraft. In the field of supersonic aircraft (probably of unorthodox shapes), of vertical take-off aircraft and of helicopters of advanced types, a whole array of new airworthiness problems will come to the fore. The Board believes that it is of the utmost importance that research on new airworthiness problems should proceed in parallel with research directed towards development of the vehicles and is addressing itself particularly to the problems for which national research work would be required.

HAWKER SIDDELEY LEADER.—Sir Roy Dobson, C.B.E., who succeeds Sir Frank Spencer Spriggs, K.B.E., as managing director of the Hawker Siddeley Group Limited (see page 5).

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Ansett Plans

MR. R. ANSETT discussed the equipment plans of the Australian airlines which he controls—Ansett-A.N.A., Queensland Airlines and Butler Air Transport—at a press conference arranged by Handley Page on June 27. He has been in Britain to discuss the purchase of new aircraft and the disposal of those which will be replaced.

He said that the Ansett group of airlines planned to operate an all-turboprop fleet based on three aircraft types—the Lockheed Electra, the Vickers Viscount 810 and either the Handley Page Dart Herald or the Fokker Friendship. A decision between the Herald and Friendship would be made after he had inspected both types and an initial order for six would be placed. In due course 12 in all of these aircraft would be needed to replace the DC-3s now operated.

The decision whether to order Heralds or Friendships was likely to be made within a fortnight, Mr. Ansett said. Technical studies had shown that both were excellent aircraft and thus the final decision between them would rest mainly on commercial factors such as their passenger appeal and the after-sales service offered by the manufacturers.

London's P.V. Rotorstation

PLANNING CONSENT for the construction of a heliport in London has been given by the Minister of Housing and Local Government to Westland Aircraft, Ltd. This welcome news follows the recent public inquiry in London into two proposals for the provision of facilities to enable helicopters to operate from a site comparatively near the centre of the Metropolis. The proposal by Rotoports, Ltd. for a heliport between Lambeth and Vauxhall bridges has been rejected by the Ministry.

Westland's heliport—construction of which will begin at once—is a private-venture project and should be ready for use by the end of the year. It will be available for the use of all operators and owners of helicopters and will be operated by the company for a period of seven years. At the end of that period, Westland's expected that there will be a permanent London Heliport provided by the Ministry of Transport and Civil Aviation.

The company feels that the establishment of this heliport will encourage the expansion of helicopter operations in Britain and may lead to heliports being set up in other cities. During 1959 the company estimates that the average weekly number of landings and passengers will be 20 and 100-125 respectively. This activity, by charter and military helicopters, should be doubled at certain times such as during S.B.A.C. Show week. Traffic may go up by some 40% in 1960. B.E.A., Sabena and charter operators have said they will use the heliport but no scheduled services are planned at present.

Located on the south bank of the Thames on a site between Battersea Railway Bridge and Wandsworth Bridge, the Westland heliport is about four miles from Hyde Park Corner or Westminster Abbey. It is about 2¼ miles from the Cromwell Road Air Terminal.

It will consist of a "T"-shaped landing platform built over the river, and an adjacent space ashore, roughly square, with a river frontage of about 200 ft. The landing area, which is the head of the "T," will measure 125 ft.×50 ft., the outer edge being 100 ft. from the bank. The width of the upright of the "T," connecting the landing platform to the shore, will be 60 ft. The area will provide parking space ashore for three helicopters the size of the Westland Westminster, or up to five smaller helicopters such as the Widgeon or Whirlwind. The cost of the project is said to be in the region of £60,000.

All approaches will be over the river which provides a straight run between bridges about 1,000 ft. downstream and 2,500 ft. upstream from the platform. It is expected that M.T.C.A. will permit taxi-ing from platform to parking area on shore, but no flying will be allowed over buildings.

Provision will be made for carrying out Customs and Passport examinations at the heliport when such services become necessary. Initially, operations are expected to be restricted to daylight only, but lighting will be installed as soon as official clearance is given for night operation.

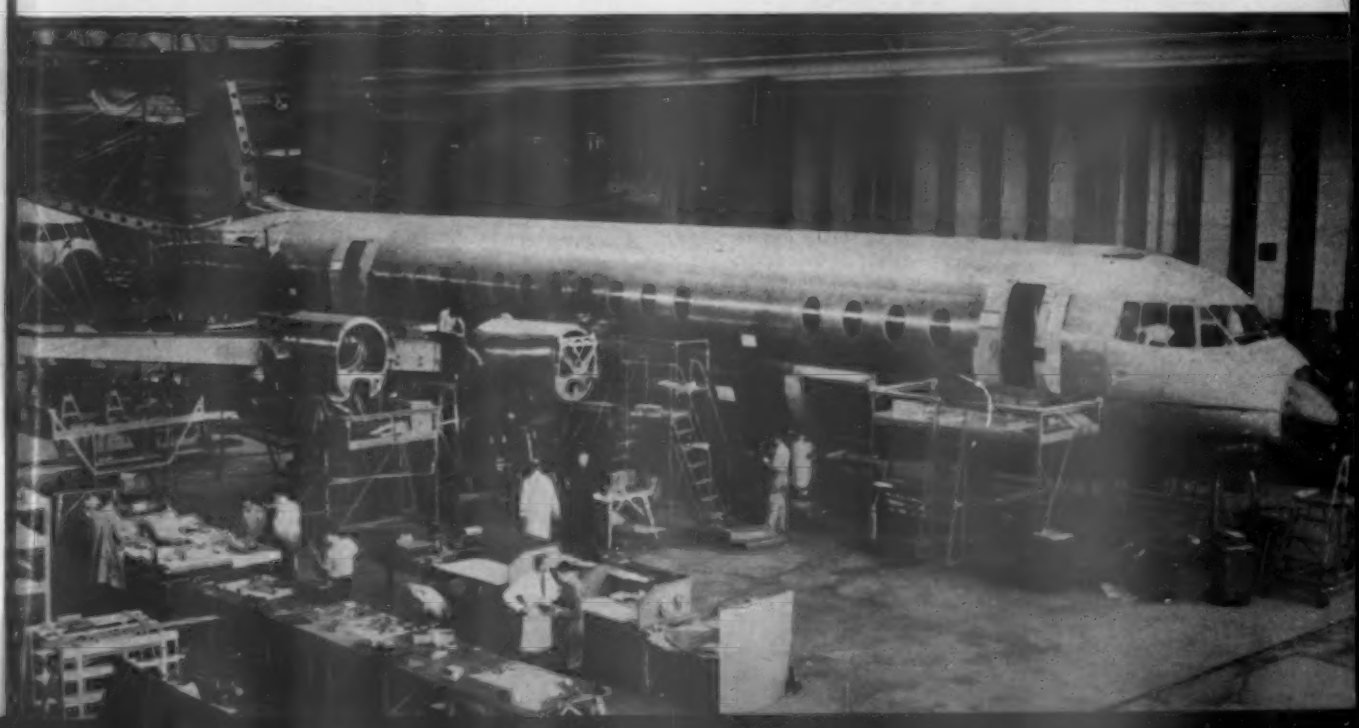
Landing fees will be the subject of discussion and agreement with the Ministry of Transport and Civil Aviation. It is Westland's intention to keep the charges as low as possible, and current thinking is that they should be of the order of £1 5s. for small helicopters (4 passengers) increasing for the larger types.

Nikes For NATO

ALTHOUGH no official announcement has yet been made, it was revealed at the recent Bierset (Liège) display that all the NATO countries are to receive the Nike-Ajax surface-to-air guided weapons system for standardized anti-aircraft defence, starting with Belgium. A significant point is that in every country except Turkey, the Nike weapons, despite their short operating range, will be the responsibility of the Air Force, and not the Army, but this will prepare the way for the longer-range Nike-Hercules, which will also be issued to NATO.

Whether or not the nuclear warheads for Nike-Hercules will

NEARING COMPLETION.—Taken recently, this exclusive photograph shows the first Vickers Vanguard airframe. The Vanguard is due to fly in the late autumn of this year, powered by four Rolls-Royce Tyne turboprops.



TURBOJET TANKER.—This Boeing KC-135A Stratotanker of the U.S.A.F., in company with another of the same type, flew from New York to London on June 27 in a record time of 5 hr. 27 min. 42.8 sec. before landing at Brize Norton. Stratotankers have the boom method of transferring fuel during flight and carry about 35,000 U.S. gallons.

Photographs copyright "The Aeroplane"

accompany these missiles has yet to be decided, but they are capable of operating with conventional explosive heads, as in the Nike-Ajax. U.S. Army units have been manning the latter weapon for some time in Germany, where some Belgian Air Force personnel have already gone for training, as well as to the United States.

Belgium should receive the first of these guided weapons by October, 1958, and these will presumably be operated by the Hunter-equipped D.A.T. (Defence Aérienne du Territoire) Command of the Belgian Air Force. A Nike-Ajax was shown by the U.S. Army at the Bierset display, which also included a Bristol Bloodhound S.A.M., with models and diagrams of its tactical deployment, and a de Havilland Firestreak A.A.M., plus drawings of a projected installation of four of these missiles beneath the wings of a CF-100 Mk. 5, using a very compact fire control and power unit in the fuselage.

A Bull's-Eye Every Time

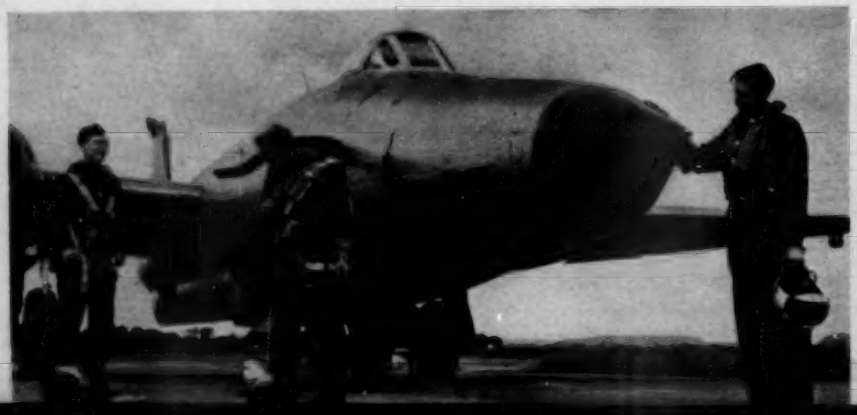
DETAILS of a new radar and fire control system for the English Electric P.1B supersonic interceptor fighter were released by Ferranti, Ltd., last week. This equipment, which is known as Airborne Interception Radar and Pilot's Attack Sight System (or AIRPASS for short), is said to be one of the most advanced and versatile airborne radar systems in the World. It was demonstrated to senior officers of the West German Air Force near Bonn recently.

In AIRPASS a "very advanced" radar unit gives information to the pilot in a simple, usable form in such a way that he can intercept his target and lock the radar beam on to it. Once this is done, the target is automatically and accurately tracked by the radar, which feeds information to the sighting system.

The Ferranti company, who have developed this new system, explained that in a typical interception ground radar will set the pilot in the general direction of the approaching target; AIRPASS will then take over. The radar beam will scan a sector of sky covering a wide angle, horizontally and vertically, on either side of the flight path, and extending many miles ahead of the fighter. When the target is located the radar will lock-on and a computer in the radar unit will automatically work out the best approach course for the pilot to follow.

The pilot follows the correct approach and completes his attack using the information presented to him in his sight. The whole operation may be completed without the target ever being seen by the pilot, but if it should come into his view he can take advantage of the normal visual sighting methods which are included in the system. An automatic warning device is incorporated to tell the pilot when to break off the attack if he should approach close enough to be in danger of colliding with the target.

As only a single container is required for AIRPASS, all the basic equipment can be housed in the "bullet" forming the centre of the P.1B's engine intake. This means that the aircraft can carry the powerful radar equipment involved without any penalties in the way of added frontal area and increased drag. It is also claimed that the weight saving accruing from having only one main component instead of a number of boxes and interconnecting cables is considerable. In point of fact, Ferranti say that the packaged design of AIRPASS is small enough to be installed in a lightweight fighter.



TARGET TRACKER.—The new Ferranti radar and fire control unit AIRPASS for the P.1B undergoing flight development testing. Below, AIRPASS fitted to the nose of a Canberra. Right, early flight trials were done with the equipment installed in a Dakota; note the compactness of the unit.

Transport Command Re-equipment

A NEWSPAPER report suggests that there is disagreement between the Air Ministry and War Office over a new military transport for R.A.F. Transport Command. The Air Ministry is said to favour the Britannic, a Britannia development jointly projected by Shorts and Bristols, while the Blackburn B.107, a development of the Beverley with four Rolls-Royce Tyne turboprops, is preferred by the War Office. Also in the field is the H.P.111, a transport development of the Victor bomber.

No comment is forthcoming from the manufacturers about this report, but Handley Page has issued certain performance figures for the H.P.111. Information about two of the aircraft concerned, the Blackburn B.107 and the Short PD.18 (the Britannic) appears on pp. 44-45 of this issue.

The payload of the H.P.111 is 30,000 lb. for a range of 5,000 nautical miles flown at 470-500 knots. In the tactical rôle the H.P.111 carries a load of 53,000 lb. over ranges up to 3,250 nautical miles at 470-500 knots. Performance figures for the H.P.111 refer to operation at different all-up weights. Over long ranges the H.P.111 will operate at maximum all-up weight between fairly large airfields. For transport duties within a fighting zone it will operate at a lower all-up weight; this will enable it to take off and land on short rough airstrips. Thus it will combine both strategic and tactical ability.

A similar versatility is characteristic of the Blackburn B.107, which cruises at lower speed and carries similar loads over short ranges and lesser loads over long-range strategic stages than does the H.P.111.

The Munich Accident

THAT a layer of frozen snow on the wing contributed considerably to the crash of the B.E.A. Elizabethan at Munich on February 6 was the principal finding of the German commission at the end of the resumed inquiry last week. There may, however, have been other contributory causes.

Witnesses had stated that, when the aircraft moved away for a third time for take-off—after returning twice with suspected engine or engine-instrument trouble—there was a firm layer of frozen snow on the upper surface of the wing. Snow had built up on the wing during the delay of 1 hr. 46 min. on the ground and it was suggested that, though the air temperature on the ground was just above freezing point, the wing structure, after a flight from Belgrade, would have been below freezing point.

The captain had told the commission that, after the aircraft had reached 117 knots during take-off, the speed had fallen and the reason for this had not been established.

Leaving Hawker Siddeleys

WITH the retirement of Sir Frank Spencer Spriggs, K.B.E., as managing director of the Hawker Siddeley Group, Ltd., the British aircraft industry loses a man whose bold foresight and planning made him one of its great personalities.

He has relinquished his position by mutual consent and has been succeeded by Sir Roy Dobson, C.B.E., managing director of A. V. Roe and Co., Ltd.

In announcing these changes last week Sir Thomas Sopwith, chairman of the Group, said that Sir Frank had been an intimate associate and friend of his for more than 44 years. For the last 23 years he had served as the Group's managing director, and the country had reason to be thankful for his decision, taken in 1936, to authorize the building of 1,000 Hawker Hurricanes—as a private venture, without Government support.

Born on March 28, 1895, Frank Spriggs joined the old Sopwith Aviation Co., Ltd., in 1913, starting as an office boy. (On the first day he cut off Mr. Sopwith in the middle of a telephone conversation and was given the sack, but it was not implemented.) By sheer merit he worked his way steadily upwards through a firm which at the end of the First World War was the World's largest aircraft manufacturing company.

When Sopwith's went into liquidation the new firm of Hawker came into being in 1920, and on the retirement of Mr. Fred Sigrist in 1925 Spriggs became managing director. Hawkers were then going ahead with the series of bombers and fighters of metal construction, beginning with the Horsley and progressing through the Hart variants. Big orders and sub-contracts were obtained.

In 1934 the Gloster Aircraft Co. was taken over by Hawkers, and Spriggs became chairman of the former firm. A year later the startling financial merger which resulted in the Hawker Siddeley Group was effected. Spriggs became a director, and a year later managing director of the Armstrong Siddeley Development Co., Ltd. Later in 1925 he assumed control of the Armstrong-Whitworth-Siddeley section at Coventry, and in 1939 he took over from Mr. Sopwith the chairmanship of various companies within the Group. He was then also elected president of the S.B.A.C.

With the curtailment of the vast orders for aircraft produced by the Group during the Second World War—including such types as the Anson, Whitley, Typhoon, Tempest, Lancaster and Lincoln—Sir Frank (he was created a Knight in 1941) had the task of reorganizing the factories, employing 100,000 workers, and extending the Group's range of products so that about 25,000 people could still be employed.

Although during those busy and anxious years Sir Frank showed little sign of strain, the increasing demands and complex problems associated with a changing industry have had their effect, and it is to be hoped that from this timely relief his health will benefit.

The new Hawker Siddeley chairman, Sir Roy Dobson, needs no introduction. He was one of the earliest of A. V. Roe's associates at Manchester and became general manager of A. V. Roe and Co., Ltd., in 1934. Since the formation of the Group he has been deeply involved in all its aspects.

News of Aircraft, Engines and Missiles

NEW AT EASTLEIGH.—Initial ground running with a slave engine was recently started at Eastleigh with the new Saunders-Roe helicopter — the P.531. A five-seater, it is powered by a Blackburn-Turboméca Turmo and is expected to fly in the near future.

NEXT WEEK

AMONG features to be in the issue of THE AEROPLANE dated July 11 will be one on the 10th anniversary of Silver City Airways; a technical description, with cut-away drawing, of the Westland Westminster, and a preview of the National Air Races, with a special feature on No. 111 aerobatic Squadron by WREN.

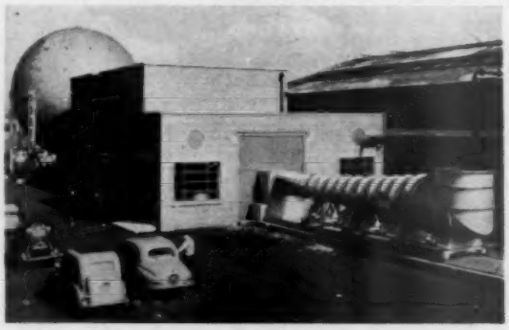
MORE POWER FOR VULCANS.—Four 16,000-lb.-st. Olympus B.Ol.6s have been installed in a Vulcan B.Mk.1 and recently flew for the first time. These engines are for the Vulcan B.Mk.2.

BELL TRANSITION.—First complete VTOL transition of the Bell X-14 research aeroplane was made on May 24. A forward speed of 160 m.p.h. and a height of 1,000 ft. have been reached.

SUPER AERO CERTIFICATE.—The Czech Super Aero light twin has recently been awarded a British validation of its C. of A. in the private category, following the installation of a direct-vision panel in the windscreen and a "stick shaker" stall-warning indicator. The first Super Aero available in the U.K., which has completed 65 hr. as a demonstrator, is now being offered for £8,950, duty paid, at Croydon by the Aircraft and General Finance Corporation, Ltd., the sole U.K. agents for this aircraft.

G.91 PROGRESS.—German and Turkish military test pilots have completed a comprehensive evaluation of the Fiat G.91 NATO light fighter, which is being developed into an improved version, the G.91A. This is to have automatic slats on the wing leading edges and two supplementary 180-litre fuel tanks, obtained by making fuel-tight a section of the inner wings. The gross weight will be increased by about 880 lb., and manœuvrability will be enhanced in turns and pull-outs. Take-off distances will be reduced by about 25% to 480 m. without external load, and 610 m. with stores. Cruising range will be increased by about 70%.

SATELLITE NAME.—New name for the Pied Piper reconnaissance satellite built by Lockheed (WS-117L) is the Century Satellite.



AVRO SUPERSONICS.—The new blow-down supersonic wind-tunnel of A. V. Roe and Co. Ltd., at Woodford, Cheshire, has a 30-in. by 27-in. working section operating between M = 1.5 and 3.5.

ANNULAR EXPERIMENT.—Powered by a turbojet developed in the Atar Volant test-beds, the subsonic SNECMA C.450 Coleopter airframe has been completed by Nord-Aviation and flight trials start soon.

Commercial Aviation Affairs

BRITANNIA TOUR.—Bristol have been flying a Britannia (one of the 305s for Northeast Airlines in Cubana de Aviacion colours) on a demonstration tour of Spain, Portugal and the Latin-American countries. After demonstrations at Madrid and Lisbon it was flown to Havana, via the Azores. On June 16 it flew (with eight ambassadors on board) to Washington and New York before returning to Havana, Miami and Atlanta, Georgia, whence it left for Lima, Buenos Aires and Montevideo. During last week the Britannia flew to São Paulo, Rio de Janeiro and Carácas, Venezuela. The 2,880-mile Rio-Carácas flight was made in 8 hr. 30 min.—a block average of 338 m.p.h.

NORTHWEST DECISION.—Northwest Airlines are reported to be in the final stages of negotiating contracts for five Douglas DC-8s and 10 Lockheed Electras, with options of four and two respectively. The Northwest DC-8s will have JT-4 engines and a gross weight of 310,000 lb. Deliveries will begin in March, 1960. The first Northwest Electra is scheduled for July, 1959.

DC-8 SPARES.—To provide DC-8 operators with adequate facilities for obtaining spares, Douglas Aircraft Co. are to establish a large stock of spares at New York International Airport, with some major assemblies also to be maintained at a central point in Europe. This will be the first time Douglas have stocked spares for a commercial aircraft away from the factory.

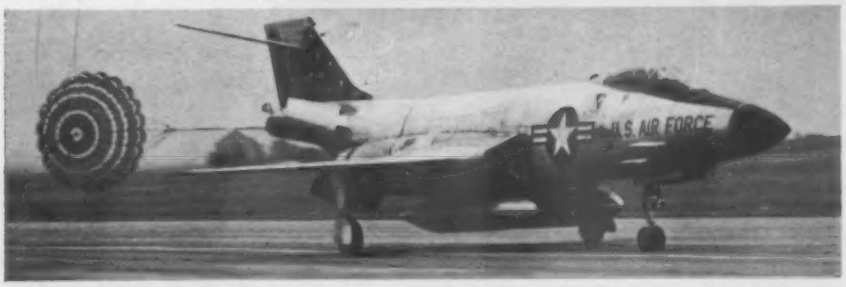
FIRST IN LONDON.—Early last month United Air Lines celebrated the 22nd anniversary of the opening of the first U.S. airline office in Europe—in London in 1936 with Huck Longfellow in charge.

(*Continued on page 8*)

Picture Report from Liège

Aircraft from 12 of the 13 NATO air forces took part in one of the biggest air displays ever held in Europe, at Bierset, near Liège, on June 29. Among the many American aircraft taking part were several newcomers to the European scene.

Photographs copyright "The Aeroplane"

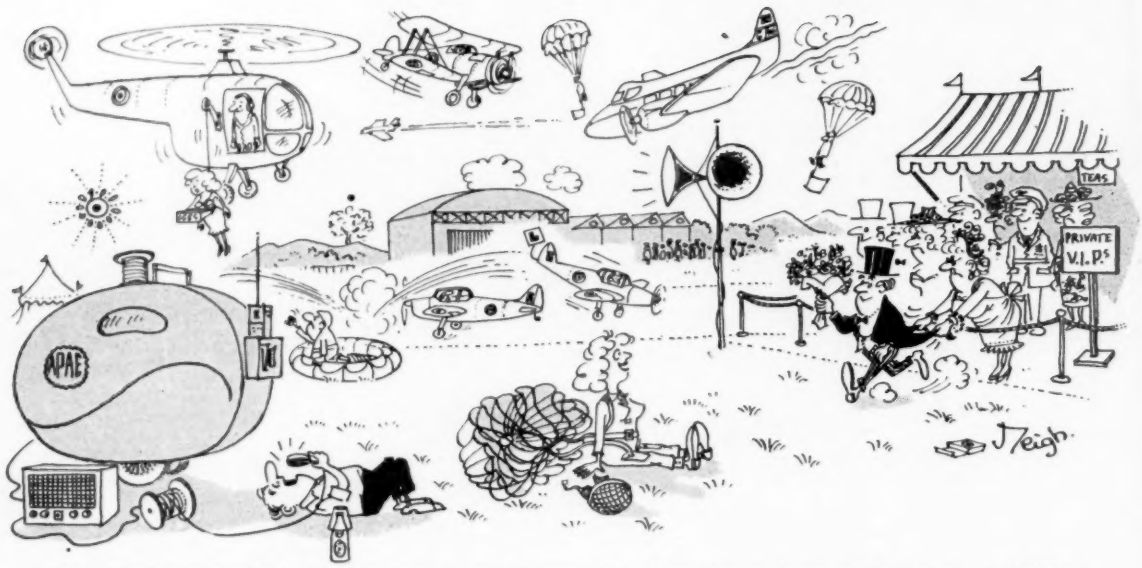


Above, included in the extensive static show at Bierset were an FJ-3 Fury, an A4D-2 Skyhawk, an F3H-2N Demon and an F8U-1 Crusader, all missile-armed and equipped for flight refuelling, from the U.S. Sixth Fleet. Bottom right is a Belgian F-84F.

Left upper, four F-101C Voodoos flew 3,455 n.m. non-stop from Washington, D.C., to Bierset, with the aid of flight refuelling, from KC-135 tankers, in 6 hr. 11 min. One was flown in the display in formation with the F-104B.

Left lower, rom the U.S.S. "Saratoga" in the Mediterranean came this M=1.65 F8U-1 Crusader, complete with Sidewinder missile racks on the fuselage.

Right, two Lockheed F-104B two-seat Starfighters from the 83rd F-I Squadron crossed the Atlantic in Douglas C-124s for the Bierset display and one was demonstrated by speed-record holder Capt. Walter Irwin. In the background are an F-101C Voodoo, and the R.A.F. and Italian aerobatic teams.



FOR AMUSEMENT ONLY.—With so many air displays now taking place—those at Exeter and Staverton were held last Saturday—we got our artist to look at some of them. This is the way he sees a typical air display.

(*Continued from page* 6)

IATA MEMBER.—The Indian Airlines Corporation has been admitted to active membership of IATA, bringing the total number to 85—of whom 77 are active. The I.A.C. will be associated with Air India International as hosts to the 14th A.G.M. of IATA which will be held in New Delhi from October 27 to 31.

Li-2 MODERNIZED.—A number of Li-2s used by LOT on domestic routes, which were bought from Russia in the years following the last war, are undergoing refitting and modernization at the LOT's Okecie base in Warsaw. They are being fitted with an efficient heating system and additional passenger seats. One of the modified Li-2s is leaving Poland on a tour of the Balkan and East European States, where it is hoped a reasonably large market exists for such conversions. It is planned also to undertake a similar modernization work for other East European air lines who operate Li-2s.

LUFTHANSA JOINS BNS.—Lufthansa has joined in the Beneswiss Agreement, formed some time ago by Alitalia, KLM, Sabena, SAS and Swissair, to facilitate reciprocal help in technical maintenance at different airports.

T.W.A. IN TROUBLE.—During the first five months of 1958 Trans World Airlines suffered a deficit of about £5 million. In consequence, 5% of the work force (about 1,000 employees) are being laid off and executives are accepting a 10% cut in their salaries.

TURBOJET TRAINING.—Lockheed Aircraft Services has been awarded a contract from American Airlines for the manufacture of maintenance and overhaul training aids for the Boeing 707 and Electra. The training and familiarization devices will be used at Tulsa, Oklahoma (A.A.'s major overhaul centre), and other bases.

Military Aviation Affairs

R.A.F. BISLEY.—Individual results at this year's R.A.F. Meeting at Bisley include: R.A.F. Rifle Championship for H.M. The Queen's Medal, Wg. Cdr. P. D. H. Thomas, R.A.F. Hornchurch; Rifle Twenty Match S.R.B., Plt. Off. Henderson, R.A.F. Boscombe Down; Revolver Championship, Flt. Lt. B. Davis, R.A.F. Wyton; Sub Machine Gun Championship, Sqn. Ldr. J. N. Williams, R.A.F. Medmenham; Small Arms Cup, Sgt. R. Richard, R.A.F. Waterbeach.

VULCAN VELOCITY.—On June 25, an Avro Vulcan of R.A.F. Bomber Command, piloted by Wg. Cdr. Frank Dodd, C.O. of No. 230 O.C.U., flew the 1,943 miles from Waddington to overhead El Adem in 3 hr. 9 min., averaging 617 m.p.h. The A.O.C.-in-C., Bomber Command, Air Chief Marshal Sir Harry Broadhurst, was co-pilot. With Lady Broadhurst (who is flying in a Transport Command Comet), he is visiting Rhodesia and Nyasaland for talks with Ministers and senior officers of the R. Rhod. A.F., which is to be equipped with Canberras early in 1959. The Vulcan averaged 606 m.p.h. between Waddington and Salisbury, taking 9 hr. 7 min. A refuelling stop was made at Embakasi, Nairobi. El Adem—Embakasi (2,530 miles) was flown in 3 hr. 58.5 min. (637 m.p.h.).

More news on page 48.

ROYAL VISITS.— Right, H.R.H. The Duke of Edinburgh visited R.A.F. Wyton on June 24, where he inspected V-bombers and flew in a Vulcan. With him, left, Air Chief Marshal Sir Harry Broadhurst. Left, on June 26, H.R.H. The Duke of Gloucester inspected No. 7 M.U., at Quedgeley, accompanied by Air Marshal H. D. Jackman, A.O.C.-in-C., Maintenance Command. With them is the C.O. of the M.U., Gp. Capt. S. W. Needham.

Commercial Aircraft of the World

This annual supplement to THE AEROPLANE offers an up-to-date illustrated guide to the characteristics, performance and recent development history of all the World's commercial aircraft which are either in production or projected. It also includes a table giving information about earlier types which are still in airline service.

A comprehensive index appears on page 46

IN the pages which follow, we present THE AEROPLANE'S second annual survey of the World's commercial aircraft. Following the pattern set last year (in the April 26 issue), we have paid special attention to standardizing and tabulating the data, in order to give this issue maximum reference value. The text which accompanies each set of data, on the other hand, is by way of being a progress report of general interest, written in most cases in the light of recent visits to the manufacturers concerned, including those in Britain, Canada, the U.S.A. and France.

Some few words of explanation are necessary. In the first place, the scope of the issue has been made as wide as possible. We have included, in the main part of the review, all aeroplanes of more than 12,500 lb. gross weight which are in production or expected to go into production for commercial use as passenger or freight transports. A separate small section deals with those few types of helicopter which, to date, can be seriously considered for commercial passenger-carrying operations. Under the heading of projects we include notes and illustrations of various types which are at present serious design studies, together with a few military aircraft with commercial potential. Finally, the "vital statistics" of the most widely used piston-engined transport types still in service have been tabulated to provide a yardstick by which the characteristics of the new generation can be better assessed.

So far as the specific data for each type is concerned, we have once again tried to select, within our own severely "space-limited payload," the particular specifications which serve to define an aeroplane's usefulness. Broadly, this data has been divided into two parts for each type; one part is concerned with engineering details—dimensions, accommodation details and a summary of engineering features in a style not previously attempted. The second tabulation presents information on powerplants, weights and loadings, design limit speeds and performance.

The design limit speeds are quoted in knots E.A.S. unless otherwise stated, or as Mach limitations with the E.A.S. in knots applicable at lower altitude also indicated. The "approach speed" is in all cases calculated on the basis of 1.3 Vso, which is the stalling speed in landing configuration, knots E.A.S. Balanced field lengths for all U.S. and most British types are in accordance with the C.A.B.'s SR422, using a 35-ft. screen (without reverse pitch in the case of propeller-driven types). Once again, our range figures are, unless otherwise noted, calculated for take-off to landing without reserves for diversion or holding. Throughout this issue, speeds are quoted in knots and distances in nautical miles.

Where they are available, we also print payload/range and cost curves. The range, again, is without reserves, and the costs are based on the A.T.A. 1955 method with modifications as indicated. So far as this has been possible, all curves are drawn on one or other of two standard grids in order to give a visually accurate comparison between types.

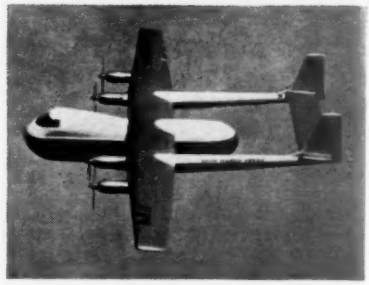
The "volume of freight and baggage holds" refers to capacity *outside* the main cabin volume.

In the preparation of this data we have called upon manufacturers throughout the World to complete an extensive questionnaire; we now gratefully acknowledge their co-operation. As a result, the data published here is a complete revision of any previous figures, and much is new, including full details of the latest Vanguard, the 310,000-lb. DC-8 and the executive Gulfstream amongst others. An official three-view drawing of the V.C.-10 is also published for the first time.

The pages are arranged as far as possible in alphabetical order under national groupings. In the index on page 46, all alternative names and designations have been included.

Commercial Aircraft . . . .

The A.W.650 and 670



IN 1956 Armstrong Whitworth decided to go ahead as a private venture with the work of developing and producing a civil freighter and coach-class passenger transport in the medium-stage, medium-capacity category. An initial series of 10 are being produced for a start, including three pre-production aircraft for flight-test and certification work.

The programme is now well advanced on the first of these A.W.650s, which is due to fly before the end of the year. In addition to this series of standard pressurized aircraft, designs have been developed for an unpressurized short-haul vehicle and/or a passenger ferry (the 670) and for a pressurized military version with an integral loading ramp (the 660).

The A.W.650 and its variants have been designed primarily for freighting rôles so, in order to obtain versatility of loading and in fuselage size and shape, a twin-boom configuration was chosen. This layout permits front and rear loading for the fuselage, with power-operated, one-piece "eggshell" doors.

A full programme of structural and water-tank pressure and fatigue testing is being completed, with fuselage specimens handled by Armstrong Whitworth and the wing testing by A. V. Roe, who are the sub-contractors for the wing design and production. Though an A.W. aircraft, with all the work co-ordinated by the A.W. design team, the aircraft is very much a co-operative undertaking, with Gloster responsible for the tail unit, flaps and some smaller components, Vickers supplying the complete Dart powerplants back to the firewall as standard Viscount 810 units but with special Rotol propellers, and A.S.T. responsible for the associated ground equipment.

The maximum gross weight given in the table (82,000 lb.) is that at which the A.W.650 will be certificated with four Dart 526s (R.Da.7/2s). When R.Da.10s become available the weight will be increased—possibly up to 100,000 lb.

The A.W.650 is being designed and produced at Whitley and Baginton, Coventry, with final assembly and test flying at Bitteswell.

Structure: Two-spar, mass-boom wing in five sections. Semi-monocoque open-ended fuselage. Twin tail booms.

Undercarriage: Retractable tricycle with twin main and nose wheels. Steerable nose-wheel.

Flaps: Double-slotted in six sections.

Flying Controls: Manually operated with spring and geared tabs. Lockable from control cabin.

Systems: Undercarriage, nose-wheel steering, brakes and flaps by 2,500–3,000 p.s.i. hydraulic system supplied by three engine-driven pumps. Emergency by self-contained electric power pack and reservoir for flaps and undercarriage up-locks, doors and nose-wheel lowering. The main undercarriage units are of the free-fall type. DC electrical supply from four 6 kW engine-driven generators; AC from two invertors with stand-bys. Three alternators for de-icing supplies. Cabin air at 5.5 p.s.i. from three engine-driven blowers. De-icing by two exhaust heat-exchangers for main plane and by electric heaters for tail unit, engine intakes, propellers and screen. Fuel from 10 bag tanks in wing.

A.W.650

Dimensions
- Span: 115 ft.
- Overall length: 86 ft. 9 in.
- Overall height: 27 ft.
- Gross wing area: 1,458 sq. ft.
- Sweepback: Nil.
- Internal cabin dimensions:
  - Length (ex. flight deck): 47 ft.
  - Max. width: 120 in.
  - Max. height: 80 in.
  - Max. usable floor area (ex. flight deck): 426 sq. ft.
  - Max. usable volume (ex. flight deck): 3,680 cu. ft.

Accommodation
- Normal first-class: 71 (6 abreast).
- Normal tourist: 77 (6 abreast).
- Max. coach: 83 (6 abreast).

Powerplants
- Four Rolls-Royce R.Da.7/2 Dart 526. Take-off power each (I.S.A., s.l.): 2,100 e.h.p. at 15,000 r.p.m. Provision for water/methanol injection. Rotol 4-blade, 11 ft. 6 in. dia. propellers.

Weights and Loadings
- Basic operational: 46,000 lb.
- Total fuel: 26,400 lb.
- Mfrs. max. payload: 28,000 lb.
- Max. take-off: 82,000 lb.
- Max. landing: 78,000 lb.
- Max. zero fuel: 74,000 lb.
- Wing loading (max. t-o. wt.): 56 lb./sq. ft.
- Wing loading (max. landing wt.): 53.5 lb./sq. ft.
- Power loading (max. t-o. wt.): 9.8 lb./e.h.p.

Design Criteria
- Design limits: Vc=230 k. Vne=256 k. Vd=291 k.

Performance
- Recommended cont. cruising speed (I.S.A.): 263 knots (at 20,000 ft. and 70,000 lb.); consumption: 360 Imp. gal./hr.; power (per engine): 14,000 r.p.m.
- Approach speed (at max. landing wt.): 100 knots.
- Balanced field lengths (at max. t-o. wt.): At I.S.A. at sea level: 4,080 ft. At I.S.A.+15°C. at sea level: 4,380 ft. At I.S.A. at 5,000 ft.: 5,500 ft.
- Landing distance from 50 ft. (unfactored, max. landing wt.): 2,940 ft.
- Range (take-off to landing), still air, no reserves, I.S.A., max. fuel (3,300 Imp. gal.): 2,480 naut. mi. with 9,400 lb. payload at 244 knots (mean) at 23,000 ft. (mean).
- Range (take-off to landing), still air, no reserves, I.S.A., with max. payload: 620 naut. mi.

A.W.670

Dimensions
- Span: 115 ft.
- Overall length: 86 ft. 9 in.
- Overall height: 27 ft.
- Gross wing area: 1,458 sq. ft.
- Sweepback: Nil.
- Internal cabin dimensions:
  - Length (ex. flight deck): 42 ft.
  - Max. width: 180 in.
  - Max. height: 84 in.
  - Max. usable floor area (ex. flight deck): 610 sq. ft.
  - Max. usable volume (ex. flight deck): 4,260 cu. ft.

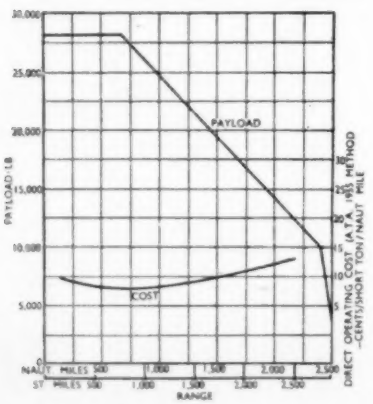
Accommodation
- Normal tourist: 116 (5 and 8 abreast).
- Max. coach: 126 (5 and 8 abreast).

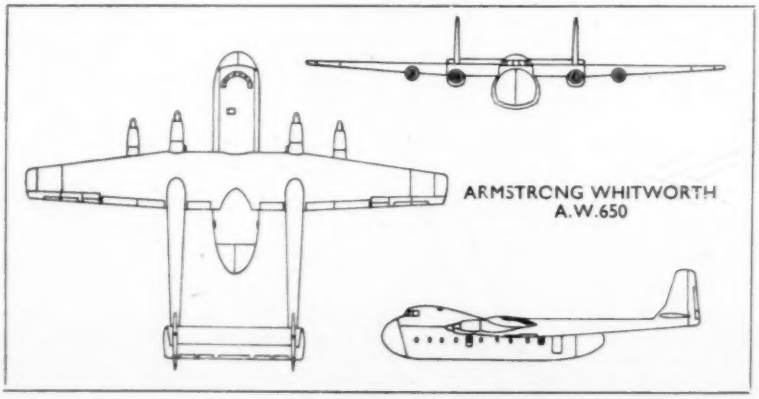
Powerplants
- Four Rolls-Royce R.Da.7/2 Dart 526; Take-off power each (I.S.A., s.l.): 2,100 e.h.p. at 15,000 r.p.m. Provision for water/methanol injection. Rotol 4-blade, 11 ft. 6 in. dia. propellers.

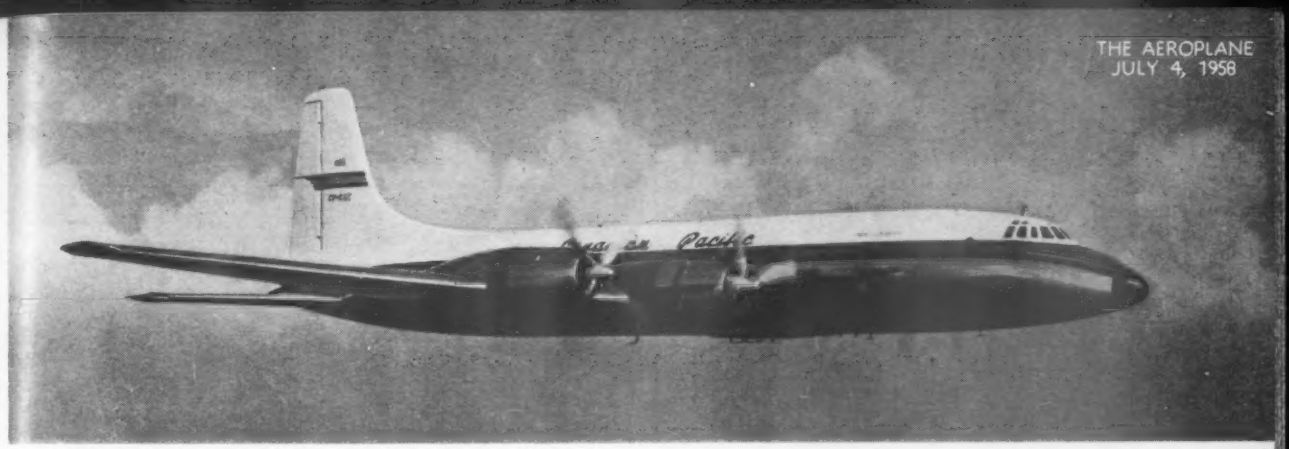
Weights and Loadings
- Basic operational: 46,400 lb.
- Total fuel: 26,400 lb.
- Mfrs. max. payload: 28,000 lb.
- Max. take-off: 82,000 lb.
- Max. landing: 78,000 lb.
- Max. zero fuel: 74,000 lb.
- Wing loading (max. t-o. wt.): 56 lb./sq. ft.
- Wing loading (max. landing wt.): 53.5 lb./sq. ft.
- Power loading (max. t-o. wt.): 9.8 lb./e.h.p.

Design Criteria
- Design limits: Vc=230 k. Vne=256 k. Vd=291 k.

Performance
- Recommended cont. cruising speed (I.S.A.): 239 knots (at 10,000 ft. and 70,000 lb.); consumption: 458 Imp. gal./hr.; power (per engine): 13,600 r.p.m.
- Approach speed (at max. landing wt.): 100 knots.
- Balanced field lengths (at max. t-o. wt.): At I.S.A. at sea level: 4,080 ft. At I.S.A. +15°C. at sea level: 4,380 ft. At I.S.A. at 5,000 ft.: 5,500 ft.
- Landing distance from 50 ft. (unfactored, max. landing wt.): 2,940 ft.
- Range (take-off to landing), still air, no reserves, I.S.A., max. fuel (3,300 Imp. gal.): 1,620 naut. mi. with 9,000 lb. payload at 210 knots (mean) at 10,000 ft. (mean).
- Range (take-off to landing) still air, no reserves, I.S.A., with max. payload: 450 naut. mi.







Commercial Aircraft . . . .

The Bristol Britannia

SINCE the very early, pre-1950, days of its initial conception, the Bristol 175 Britannia has been through an immense series of developments and changes—from a medium-haul, medium-capacity aircraft for B.O.A.C.'s Commonwealth routes to a long-haul, large-capacity passenger and/or cargo transport.

The original prototype order was placed in July, 1948; a contract was signed by the Corporation in July, 1949; and the full manufacturing programme for the aircraft was started in January, 1951. The first prototype flew on August 16, 1952, following a substantial amount of preliminary research work and the development of a full-scale functional mock-up for the systems, controls and flight-deck installation. The second (production standard) prototype flew on December 23, 1953, but was lost later after a test flight. The first production aircraft flew on September 5, 1954.

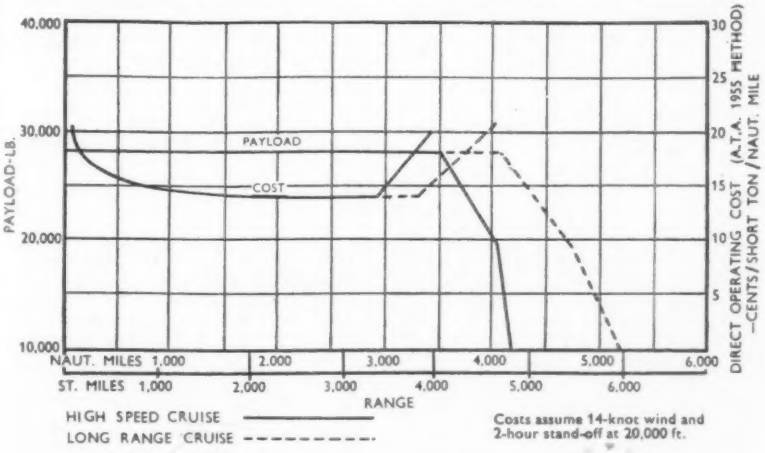
The different variants of the Britannia and their purchasers, and the performances of the two main variants, are given in accompanying tables, but it might be as well to add qualifying and explanatory notes.

The 100 series (the 102 for B.O.A.C.) was the initial type and 15 of these are now in service. It is powered with Proteus 705 turboprops of 3,780 e.h.p. and has a maximum take-off weight of 155,000 lb. The 300 series has a fuselage 10 ft. 3 in. longer than that of the 100 and is powered by 4,120 e.h.p. Proteus 755s.

There are two variants in the 300 series—the 302, which has the original tankage of 6,690 Imp. gallons, a maximum payload of 30,000 lb. and a maximum take-off weight of 165,000; and the 305, which has the later wing with its tankage of 8,580 Imp. gallons and a permissible maximum weight of 175,000 lb. The 305 is, in effect, a 300 brought up as nearly as possible to the long-haul 310 standard.

The 310 series is the long-range version of the 300, with a fuel capacity of 8,580 Imp. gallons and a maximum gross weight of 180,000 lb. The variant now on offer to the airlines is the 320, which has the Proteus 765 instead of the 755 of the 300 and 310s. This developed engine gives an additional 260 s.h.p. (3,960 s.h.p.) for take-off, has a lower specific consumption and a higher cruise power (3,520 s.h.p. compared with 3,485 s.h.p.) The Proteus 705, incidentally, was cleared to 1,300 hours between overhaul after 13 months in service.

A cargo or passenger/cargo version of



BRITANNIA ORDERS

Customer	Quantity	Option	Announced value	Date of contract announcement	Delivery	Remarks
B.O.A.C.	15	—	—	July, 1949	Dec., 1955/57	Model 102
B.O.A.C.	18	—	—	Aug., 1955	Dec., 1957	Model 312
El Al	3	1	—	June, 1955	Sept., 1957	Model 313
C.P.A.	6	5	$12m.	Oct. 3, 1955 April 2, 1956 April 1, 1957	April, 1958	Model 314
Hunting Clan	2	1	£2.5m.	Dec., 1956	Sept., 1958	Model 317
Northeast Airlines*	5	—	$6m.	Dec., 1956	July, 1958	Model 305
Aeronaves	2	—	$8m.	June, 1957	Nov., 1957	Model 302
Cubana	2	—	—	June, 1957	1958..	Model 318
M.o.S.	3	—	—	Feb., 1955	—	Model 252
R.A.F. Transport Command	20	—	—	Nov. 6, 1955 May 4, 1956 Dec. 3, 1956 Oct. 7, 1957	1959..	Model 253

Prototypes 100 Series G-ALBO 300 Series G-ANCA (crashed)
G-ALRX (forced landed, written off)

* Contract not concluded

BRITANNIA 102

Dimensions
- Span: 142 ft. 3.5 in.
- Overall length: 114 ft.
- Overall height: 37 ft. 4.5 in.
- Gross wing area: 2,075 sq. ft.
- Sweepback: Nil (on 80% mean chord).
- Internal cabin dimensions:
  - Length (ex. flight deck): 67 ft. 2.4 in.
  - Max. width: 137 in.
  - Max. height: 80 in.
  - Max. usable floor area (ex. flight deck): 737 sq. ft.
  - Max. usable volume (ex. flight deck): 5,150 cu. ft.

Accommodation
- Normal first-class: 79 (5 abreast).
- Normal tourist: 90 (6 abreast).
- Max. coach: 108 (6 abreast).
- Volume of freight and baggage holds: 845 cu. ft. in two holds.

Powerplants
- Four Bristol Proteus 705.
- Take-off power each (I.S.A., s.l.): 3,780 e.h.p. at 11,700 r.p.m.
- Four 16-ft. de Havilland four-blade c.s. and braking propellers.

Weights and Loadings
- Basic operational: 88,000 lb.
- Total fuel: 52,920 lb.
- Mfrs. max. payload: 25,000 lb.
- Max. take-off: 155,000 lb.
- Max. landing: 125,000 lb.
- Max. zero fuel: 113,000 lb.
- Wing loading (max. t-o. wt.): 74.7 lb./sq. ft.
- Wing loading (max. landing wt.): 60.2 lb./sq. ft.
- Power loading (max. t-o. wt.): 10.25 lb./e.h.p.

Design Criteria
- Design limits: Vc=234 k. E.A.S. Vne=276 k. I.A.S. Vd=295 k. E.A.S.

Performance
- Typical high cruising speed (I.S.A.): 315 knots (at 20,000 ft. and 135,000 lb.); consumption: 640 Imp. gal./hr.; power (per engine): max. continuous.
- Approach speed (at max. landing wt.): 110.5 knots I.A.S.
- Balanced field lengths (at max. t-o. wt.):
  - At I.S.A. at sea level: 6,300 ft.
  - At I.S.A.+15°C. at sea level: 7,350 ft.
  - At I.S.A. at 5,000 ft.: 8,000 ft.
- Landing distance from 50 ft. (unfactored, max. landing wt.): 3,650 ft.
- Range (take-off to landing), still air, no reserves, I.S.A., max. fuel (6,690 Imp. gal.): 3,980 naut. mi. with 13,736 lb. payload at 285 knots (mean) at 28,000 ft. (mean).
- Range (take-off to landing), still air, no reserves, I.S.A., with max. payload: 3,000 naut. mi.

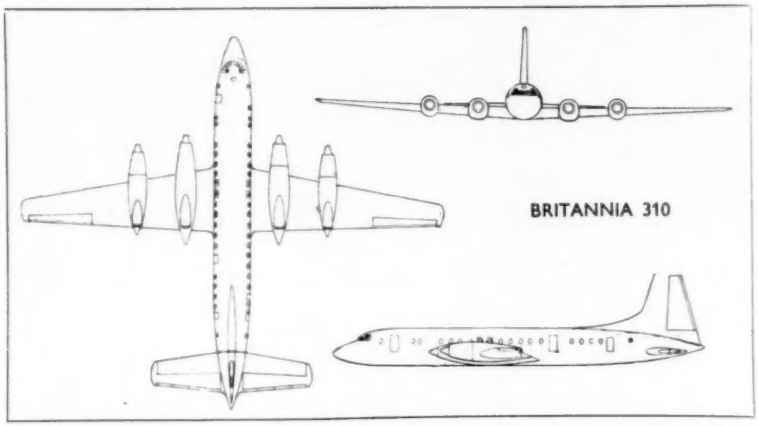
Commercial Aircraft . . . .

the 310 is the Series 250, which is in two variants—the 252, for mixed passenger/cargo work, and the 253, an all-cargo version which can also be used for trooping. The 252 has a maximum payload of 28,000 lb. (including 84 passengers) and the 253 has a maximum (cargo) payload of 34,000 lb. The range and speed performances are similar to those of the 310/320 series.

The first 300 flew on July 31, 1956, and the first 310 on December 31, 1956.

Production of the Britannia is at Filton, Bristol, and at the Belfast factory of Short Brothers and Harland, with whom an agreement was concluded by Bristol in December, 1953.

Details of the Canadian variants and developments of the Britannia will be found under the Canadair CL-44D heading (p. 30).



Structure: Box spar wing in two main units, joined at centre line of fuselage. Detachable wing tips. Structural weight less than 25% of basic weight. Semi monocoque fuselage. Integral and bag-type fuel tanks.

Landing Gear: Four-wheel bogie main units and twin-wheel, steerable nose unit. Disc brakes.

Flaps: Double-slotted Fowler-type, electrically operated.

Flying Controls: Aerodynamic full-servo type operated by tabs on each surface. Spring-feel for ailerons and rudder; "q" feel for elevators.

Systems: 4,000 p.s.i. hydraulic for landing gear, wheel brakes, nose-wheel steering and control-system ground locks. Separate hydraulic system for "q"-feel and control damping.
Four electrically driven pumps and accumulators which can be off-loaded from the system at all times except take-off and landing. Electrical supply from four 47 kVA. cooled three-phase alternators and transformer rectifying units are 208V. AC, 112 and 28V. DC. Electrical load can be carried by any two engines, feeding busbars, all essential services can be maintained even after split busbar operation. There are five invertors for radio and instruments fed from MV 112V. busbar. Cabin differential pressure up to 8.3 p.s.i. tapped from engine compressors.
De-icing of wing and engine intakes by hot gas from turbine casing and by electrically heated spray mats on tailplane, fin and elevator horn balances. Propellers and windscreen by electrical elements.

BRITANNIA 320

Dimensions
- Span: 142 ft. 3.5 in.
- Overall length: 124 ft. 3 in.
- Overall height: 37 ft. 4.5 in.
- Gross wing area: 2,075 sq. ft.
- Sweepback: Nil (on 80% mean chord).
- Internal cabin dimensions:
  - Length (ex. flight deck): 77 ft. 0 in.
  - Max. width: 137 in.
  - Max. height: 80 in.
  - Max. usable floor area (ex. flight deck): 837 sq. ft.
  - Max. usable volume (ex. flight deck): 5,877 cu. ft.

Accommodation
- Normal first-class: 99 (5 abreast)
- Normal tourist: 101 (6 abreast)
- Max. coach: 133 (6 abreast)
- Volume of freight and baggage holds: 819 cu. ft. in two holds.

Powerplants
- Four Bristol Proteus 765.
- Take-off power each (I.S.A., s.l.): 4,237 e.h.p. at 11,775 r.p.m.
- de Havilland 16-ft. four-blade, c.s., feathering and reversing propellers.

Weights and Loadings
- Basic operational: 92,040 lb.
- Total fuel: 68,376 lb.
- Mfrs. max. payload: 29,000 lb.
- Max. take-off: 180,000 lb.
- Max. landing: 135,000 lb.
- Max. zero fuel: 122,000 lb.
- Wing loading (max. t-o. wt.): 86.8 lb./sq. ft.
- Wing loading (max. landing wt.): 65.0 lb./sq. ft.
- Power loading (max. t-o. wt.): 10.6 lb./e.h.p.

Design Criteria
- Design limits: Vc=244 k. E.A.S. Vne=284 k. I.A.S. Vd=306 k. E.A.S.

Performance
- Typical high cont. cruising speed (I.S.A.): 345 knots (at 22,000 ft. and 140,000 lb.); consumption: 700 Imp. gal./hr.; power (per engine): max. continuous.
- Approach speed (at max. landing wt.): 114 knots I.A.S.
- Balanced field lengths (at max. t-o. wt.): At I.S.A. at sea level: 7,200 ft. At I.S.A. +15°C. at sea level: 8,600 ft. At I.S.A. at 5,000 ft.: 10,100 ft.
- Landing distance from 50 ft. (unfactored, max. landing wt.): 3,500 ft.
- Range (take-off to landing), still air, no reserves, I.S.A., max. fuel (8,547 Imp. gal.): 4,790 naut. mi. with 19,584 lb. payload at 310 knots (mean) at 29,000 ft. (mean).
- Range (take-off to landing), still air, no reserves, I.S.A., with max. payload: 4,060 naut. mi.

The D.H.121

ORDERED by B.E.A. in February this year after a protracted struggle at high political and other levels, the D.H.121 is a turbojet transport specifically designed for the short-haul operators but with the capacity for range-stretch with modifications. The Corporation has ordered 24, with an option on a further 12, and it is due to enter service in 1964.

Powered by three Rolls-Royce R.B.141 by-pass turbojets of about 12,000 lb.s.t. each, grouped near the rear of the fuselage, the design of the 121 is in line with present European turbojet trends. No details have been released about the performance, but the broad B.E.A. requirements (July, 1956) called for an aircraft which would carry 70-80 passengers in standard-class seating, or 95-100 passengers in high-density-class seating, over stage distances of about 1,000 miles at a speed of 600 m.p.h.

De Havillands have stated that the basic design will embody a considerable measure of adaptability in the matter of stage-length with capacity payload and

that emphasis will be placed on economy and on the ability to operate from 6,000-ft. runways. It is to be assumed that the clean wing, free of powerplants, may have leading- and trailing-edge flaps, or other high-lift devices, and that the maximum gross weight of the short-haul version will be about 110,000 lb.

The D.H.121 followed three other projects to meet the two Corporations' requirements.

The responsibility for the financing, development and production of the D.H.121 lies with the Aircraft Manufacturing Company, in which the participants are the de Havilland Aircraft Co. (67½%), Hunting Aircraft (22½%) and The Fairey Aviation Co. (10%).

Commercial Aircraft . . . .

The de Havilland Comet

Photograph copyright "The Aeroplane"

THE Comet, in its Mark 1 form, was the first civil turbojet transport to go into operational service and the Comet 4 variants are direct, but much developed, descendants of the original series, the first of which made its initial flight on July 27, 1949. The type has an unprecedented background of test and operational flying (amounting to more than 50,000 hours) and of ground testing. The Comet's Rolls-Royce Avon engines have a background of about 1.25 million hours of flying and the R.A.29 Mark 524 in the Comet 4 will start its airline career with an inter-overhaul life of 750 hours.

As the D.H.106, the Comet 1 was ordered in January, 1947, and entered service with B.O.A.C. on May 2, 1952. The Mark 1 and 1A were also operated by Air France, U.A.T. and the R.C.A.F. before being withdrawn from service in April, 1954. The Avon-engined Comet 2 first flew on August 27, 1953, and, after the testing and modifications following the Elba and Naples accidents in 1954, entered service with the R.A.F. in June, 1956. Since then 10 of them have flown more than 110,000 hours in routine operations eastwards to Australia and westwards to Christmas Island in the Pacific. The R.C.A.F.'s two Ghost-engined Comet 1As (modified since their original delivery) have continued in service.

The Comet 3—the prototype of a logically stretched development of the Marks 1 and 2—first flew on July 19, 1954, and has been progressively modified for use as a prototype for the Comet 4.

In February, 1957, it was fitted with R.A.29 engines and it has since completed about 80% of the test work necessary for the certification of the Comet 4—the first of which flew from Hatfield on April 27 this year.

Meanwhile, two Comet 2Es, each with two R.A.29s in the outboard nacelles, have been flown by B.O.A.C. since September, 1957, on engine-proving and training work. These flights were initially made day by day on the non-stop London-Beirut run and the 2Es had, by mid-

Structure: Wing made up of centre section, two stub wings and two extension wings. Two-spar construction inboard, semi-monocoque outboard. Integral fuel tanks in stub and extension wings and nacelle tanks. Semi-monocoque fuselage "lifed" to more than 200,000 hours (unfactored).

Undercarriage: Four-wheel bogie main units and two-wheel steerable nose unit.

Flaps: Plain outer pairs and split-type inner pairs.

Air Brakes: Slotted plates above and below each wing.

Flying Controls: Fully power-operated by duplicated hydraulic and mechanical units and three separate sources of hydraulics. The ailerons incorporate spring-feel only; the elevator spring-feel plus "q" feel; and the rudder spring-feel plus "q" restrictor. Two-speed gearing for the elevators.

Systems: Four-circuit (plus handpump) 2,500-p.s.i. four-engine-pump hydraulic system (with two electric-motor-driven pumps as reserve) for flying controls, undercarriage, flaps, air brakes, wheel-brakes and nose-wheel steering. Electrical supply from four 14 kVA alternator/rectifier combinations to busbar system normally single, but divisible under fault conditions. Cabin air (at 8.75 p.s.i.) tapped from last-stage compressors of all engines. De-icing of wings, tailplane, fin and engine-intakes by hot air from engine compressors of all engines.

COMET ORDERS

Customer	Quantity	Option	Announced value	Date of contract announcement	Delivery	Remarks
B.O.A.C.	19	—	—	Feb., 1955	1958	Mark 4
B.E.A.	6	—	£7m.	Aug. 30, 1957	Early 1960	Mark 4B
Aerolineas Argentinas ..	6	—	£10m.	Mar. 19, 1958 (ratified May 1)	1958–60	Mark 4

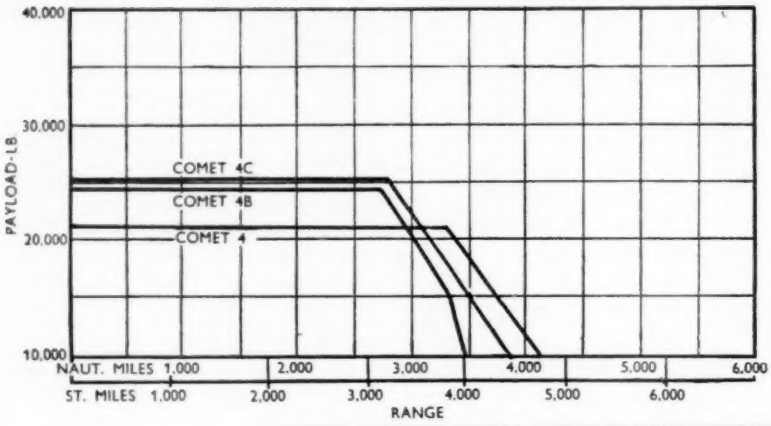
	Mark 4	Mark 4B	Mark 4C
Dimensions:			
Wing Span, ft. in.	114 9	107 10	114 9
Overall length, ft. in.	111 6	118 0	118 0
Overall height, ft. in.	28 6	29 6	28 5
Gross wing area, sq. ft.	2,121	2,059	2,121
Sweepback, deg. on 25% M.A.C.	20	20	20
Internal cabin dimensions, ex. flight deck, length, ft. ..	71.73	78.23	78.23
Max. width, in.	115.7	117	117
Max. height, in.	78.7	78.5	78.5
Max. usable floor area, sq. ft.	439	529	529
Max. usable volume, cu. ft.	2,815	3,160	3,160
Volume of baggage and freight holds outside cabin, cu. ft.	570 (3)	640 (3)	640 (3)
Accommodation:			
Normal first class	60	68	68
Normal tourist	71	89	89
Max. coach	90	104	104
Powerplants:			
Type and number	4 Avon 524	4 Avon 525	4 Avon R.A. 29/1
Rated take-off power (i.s.a. at s.l.) lb.s.t./r.p.m.	10,500/8,000	10,500/8,000	10,500/8,000
Weights and loadings:			
Basic operational weight, lb.	74,100	77,950	77,400
Total usable fuel, lb.	71,920	63,120	71,920
Mfrs. max. payload, lb.	20,900	24,550	25,100
Max. take-off, lb.	156,000	156,000	156,000
Max. landing, lb.	114,000	118,500	118,500
Max. zero fuel, lb.	95,000	102,500	102,500
Wing loading, max. t-o.wt., lb./sq. ft.	73.4	76	73.4
Wing loading, max. landing wt., lb./sq. ft.	53.8	57.6	55.8
Power loading, max. t-o. wt., lb./lb.s.t.	7.09	7.09	7.09
Design limit speeds:			
Mc/Vc (knots E.A.S.)	0.76/280	0.76/325	0.76/260 (I.A.S.)
Mne/Vne (knots I.A.S.)	0.78/320	0.77/355	0.78/290
Md/Vd, (knots E.A.S.)	0.84/360	0.84/405	0.84/330
Performance:			
Recommended cont. cruising speed, knots	448	462	442
At altitude, ft./weight, lb.	28,500/135,000	23,500/135,000	33,000/135,000
With consumption, Imp. gal./hr.	1,140	1,430	1,090
Approach speed (1.3 Vso), knots/at weight, lb.	115/100,000	120/110,000	115/100,000
Balanced field length, at max. t-o. wt., I.S.A. at s.l., ft. ..	6,700	6,800	6,700
I.S.A. +15°C. at s.l., ft.	7,500	7,600	7,500
I.S.A. at 5,000 ft.	9,700	9,800	9,700
Landing distance from 50 ft. (unfactored), at max. landing wt., ft.	3,560	3,730	3,750
Range with max. fuel, t.o. to landing, no reserves, still air, I.S.A., naut. miles	4,130	3,340	4,100
With payload, lb./fuel, Imp. gal.	10,000/8,990	14,950/7,890	6,700/8,990
At mean speed, M/altitude, ft.	0.70/37,000	0.71/36,000	0.70/37,000
Range with max. payload, naut. miles	3,290	2,720	2,770

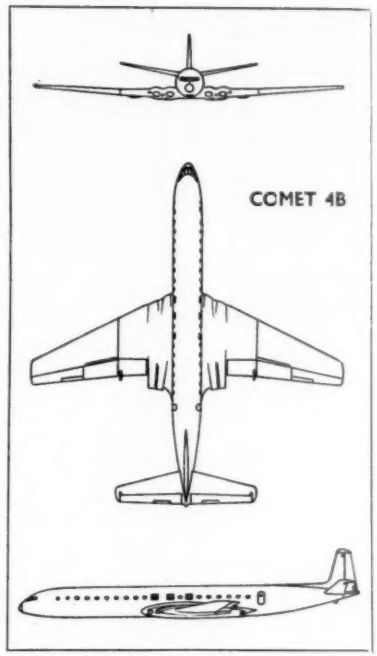
Commercial Aircraft . . . .

June, flown more than 3,850 hours. More recently the 2Es have been flown to Gander, via Keflavik, on Atlantic proving and training flights and are now completing a series of flights into New York and the airports of the Maritimes.

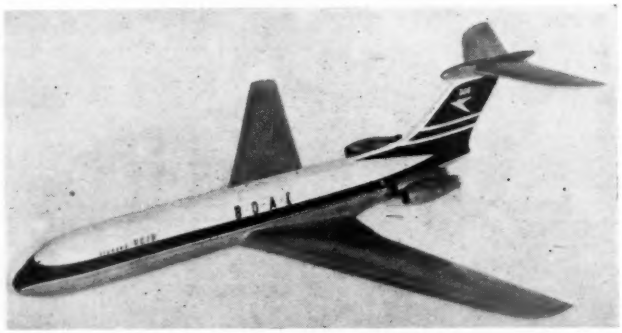
The Comet 4 is available in three forms: The Intercontinental (56-76 passengers) for long-haul work on sector-distances up to 3,000 miles; the shorter-span-wing, lower-level-cruising Continental 4B (up to 100 passengers) for sector-distances of 300-1,500 miles; and the Intermediate 4C, which has the passenger-capacity of the 4B with the Mark 4 wing.

Comets are being assembled at Hatfield and at the D.H. factory at Hawarden, Chester. Deliveries to B.O.A.C. are due during this year and the Corporation plans to introduce them initially on the North Atlantic service from December 1, with, possibly, a daily service to New York from January 1.





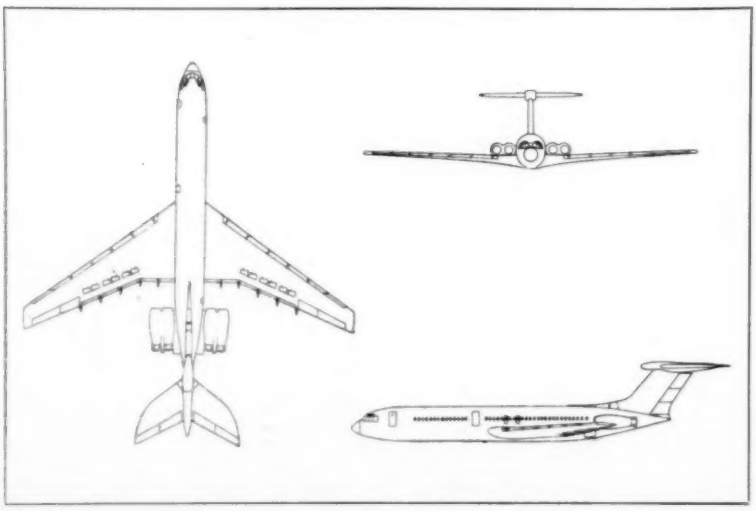
The Vickers V.C.10



PLANNED originally as a medium-long-haul turbojet aircraft for Commonwealth-route operations by B.O.A.C., the V.C.10 (Vickers Type 1101) design eventually emerged as an aircraft suitable for non-stop North Atlantic operations. On January 14 this year the Corporation announced an order for 35 and an option on another 20 of these next-generation, long-haul turbojet transports, which are to be powered by four Rolls-Royce Conways mounted in pairs on each side of the rear fuselage. Present version of the Conway planned for the V.C. 10 is the 16,750-lb. s.t. R.Co.16.

VICKERS V.C.10 ORDERS

Customer	Quantity	Option	Announced value	Date of contract announcement	Delivery begins	Remarks
B.O.A.C. ..	35	20	£60m.	May 22, 1957	1963	Value excludes spares.



The V.C.10's most important performance feature is its promised ability to operate out of limited-size airfields at high altitudes and high temperatures. The position of the powerplants was, in fact, decided not for æsthetic or passenger-comfort reasons, but in order to leave the wing clear for the most effective application of leading- and trailing-edge flaps. The fuselage will be of double-radius section, with large-capacity freight holds.

The figures so far given for the V.C.10 are: Span, 140 ft.; length, 160 ft.; height, 41 ft. 2 in.; wing area, 2,800 sq. ft.; passenger-floor width, 11 ft.; fuselage width, 12 ft. 4 in.; and maximum gross weight (long-haul version), 299,000 lb. Design studies have been made for weights up to 310,000 lb.

The first aircraft is due to fly in 1961 and the first production deliveries, of an initial fleet to B.O.A.C., will be made in 1963.

Commercial Aircraft . . . .

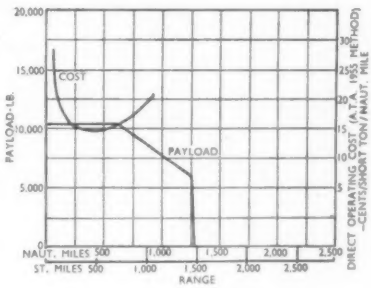
The Handley Page Dart Herald

IN THE AEROPLANE'S Commercial Aircraft Number last year the Herald was dealt with in its four-piston-engine version and only casual mention was made of a projected twin-turboprop variant. During the intervening 14 months the Dart Herald has been produced (also as a private venture) and was flown on March 11 this year. The Leonides-powered Herald flew on August 25, 1955, and the first full public announcement about the basic type was made in October, 1954.

Designed as a short-haul, medium-sized transport for hard work in a relatively under-developed environment, the original Herald was built around the average requirements of operators in this category. The transformation from the four Leonides to the two-Dart (R.Da.7/2 Mk. 527) version has not appreciably altered the basic design, though the opportunity was taken to bring the structure up to 1956 B.C.A.R. and C.A.A. requirement standards.

The principal difference between the two aircraft is the higher cruising speed of the Dart version; this involved certain structural changes in the wing, which also, because of the need for greater standard fuel capacity, now has two 200-gal. integral fuel tanks in the inboard sections of the outer wings. The basic fuselage structure has remained unchanged, though an extra 20-in. bay has been added forward of the centre-section and the windows are 4 in. deeper.

The performance of the Dart Herald has changed from that of the earlier version in four main respects. The mean cruising speed is now 241 knots at 15,000 ft. by comparison with 182 knots at 10,000 ft.; the take-off balanced field length (max. weight, sea-level, I.S.A. conditions) has increased from 2,916 ft. to 3,700 ft.; the no-allowance range with maximum payload has increased from 230 naut. miles to 610 naut. miles; and the full-tank payload from 4,115 lb. to 6,100 lb. The maximum no-allowance range is 1,260 naut. miles.



DART HERALD

Powerplants
Two Rolls-Royce R.Da.7/2 Dart 527.
Take-off power each (I.S.A., s.l.): 2,105 e.h.p. at 15,000 r.p.m.
Provision for water/methanol injection.
Rotol 4-blade propellers, 12 ft. 6 in. diameter.

Weights and Loadings:
Basic operational: 22,808 lb.
Total usable fuel: 8,000 lb.
Mfrs. max. payload: 10,160 lb.
Max. take-off: 37,000 lb.
Max. landing: 37,000 lb.
Max. zero fuel: 32,968 lb.
Wing loading (max. t-o. wt.): 41.7 lb./sq. ft.
Wing loading (max. landing wt.): 41.7 lb./sq. ft.
Power loading (max. t-o. wt.): 8.8 lb /e.h.p.

Design Criteria
Design limits: Vc=206 k. Vne=240 k. Vd=267 k.

Performance
Recommended cont. cruising speed (I.S.A.): 241 knots (at 15,000 ft. and 35,500 lb.); consumption: 203.6 Imp. gal./hr.; power (per engine): 13,800 r.p.m.
Approach speed (at max. landing wt.): 90 knots.
Balanced field lengths (at max. t-o. wt.): At I.S.A. at sea level: 3,700 ft.
At I.S.A.+15°C. at sea level: 3,900 ft.
At I.S.A. at 5,000 ft.: 4,550 ft. (34,900 lb.).
Landing distance from 50 ft. (unfactored, max. landing wt.): 2,260 ft.
Range (take-off to landing), still air, no reserves, I.S.A., max. fuel (1,000 Imp. gal.): 1,260 naut. mi. with 6,095 lb. payload at 243 knots (mean) at 17,400 ft. (mean).
Range (take-off to landing), still air, no reserves, I.S.A. with max. payload: 610 naut. mi.

Dimensions
Span: 94 ft. 9.5 in.
Overall length: 71 ft. 11 in.
Overall height: 22 ft. 4 in.
Gross wing area: 886 sq. ft.
Sweepback: Nil.
Internal cabin dimensions:
Length (ex. flight deck): 43 ft. 8 in.
Max. width: 102 in.
Max. height: 75 in.
Max. usable volume (ex. flight deck): 1,682 cu. ft.

Accommodation
Normal first-class: 36 (4 abreast).
Normal tourist: 43 (4 abreast).
Max. coach: 47 (4 abreast).
Volume of freight and baggage holds: None.

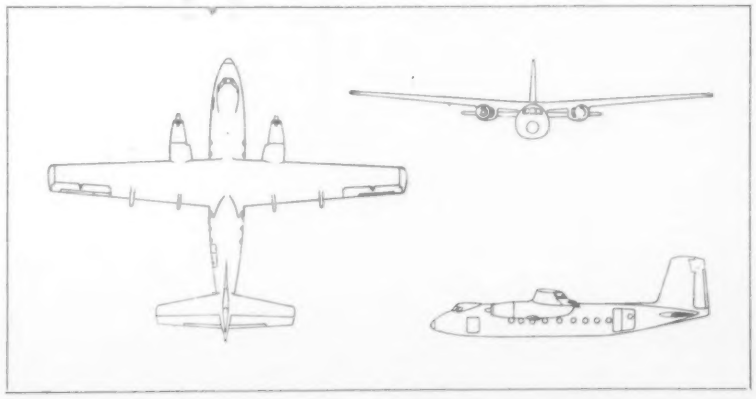
Structure: Three-spar wing centre section and two-spar outer wings with detachable tips. Stressed-skin fuselage. Extensive use made of spot-welding and sandwich construction techniques throughout airframe.

Undercarriage: Two-wheel nose and main units. Steerable nose unit.

Flaps: Large-span Fowler type.

Flying Controls: Rod-, cable- and chain-operated. Spring-tabbed ailerons and rudder, geared tab on elevator.

Systems: Undercarriage retraction, flap operation, braking, nosewheel steering and self-centring by 3,000 p.s.i. hydraulic system supplied by two engine-driven pumps. Electrical supply from two 28-V. 6-kW D.C. generators, one on each engine. Four 24-V. batteries for starting, general and emergency use. Cabin air at 3.35 p.s.i. supplied by two engine-driven blowers. De-icing of wing, fin and tailplane leading edges by hot air ducted from engine exhaust heat-exchanger. Liquid system de-icing for windscreen. Fuel supplied from four 175-gal. bag tanks in centre section and two 200-gal. integral tanks one in each outer wing.



The Vickers Viscount 700 and 800 Series

Commercial Aircraft . . . .

THE first production-type Viscount (the 700 Series) was developed from a smaller prototype (the 630) which was originally named the Viceroy. The 630 flew on July 16, 1948, and two years later was being used by B.E.A. on scheduled services—during August, 1950. The larger 700 Series flew on August 28, 1950, and went into airline service with B.E.A. as the 701 on April 18, 1953.

The 700 prototype, with 1,400-s.h.p. Dart 505s, had a gross weight of 48,000 lb., rising later to 50,000 lb. The production 701 started at 57,000 lb., increasing to 58,500 lb. Developments in the Dart engine and modifications to the airframe have since permitted weights up to 64,500 lb. for aircraft in the 700 Series and up to 69,000 lb. for aircraft in future 800 Series. The first of the larger-fuselage Viscounts, the 800 Series (the 802 for B.E.A.), flew in July, 1956 and entered service in February, 1957.

Tables on these pages give the details and performance of the various Viscount Series; the dates and numbers of aircraft in the orders so far placed; and summaries of the basic engineering features. But it will be helpful if the differences between the five basic Viscount types are outlined. All are powered by various marks of Rolls-Royce Dart. The later Viscounts have provision for the fitting of pairs of 145-gal. removable slipper tanks—or, with modification and for the 810/840 Series, of 250-gal. tanks.

The original 700 Series are currently operating as 40-53-passenger aircraft, and were initially powered by Dart 505s; all engines have since been modified to the 506 standard, giving 1,400 s.h.p. for take-off. The first operators of the 700 were B.E.A., Aer Lingus and Air France. The individual type numbers are 700-744.

The 700D is dimensionally similar to the 700, but has Dart 510s of 1,600 s.h.p. allowing increases in weight and in cruise speed. As a variant it was first delivered to Central African Airways. A further variant is the 770D, which is a standardized aircraft designed to meet North American requirements. The range of type numbers for these variants is 745-799.

A more recent type is the 790, which embodies special features to make it suitable for local service operations in the U.S.A. It can, for instance, fly up to five

	700D	790	800	810	840
Dimensions:					
Wing span, ft. in.	93 8½	93 8½	93 8½	93 8½	93 8½
Overall length, ft. in.	81 10	81 10	85 8	85 8	85 8
Overall height, ft. in.	26 9	26 9	26 9	26 9	26 9
Gross wing area, sq. ft.	963	963	963	963	963
Sweepback, deg. on 25% M.A.C.	Nil	Nil	Nil	Nil	Nil
Internal cabin dimensions, ex. flight deck:					
Length, ft. in.	45 0	45 0	54 0	54 0	54 0
Max. width, in.	119.0	119.0	119.0	119.0	119.0
Max. height, in.	78.0	77.5	78.0	78.0	78.0
Max. usable floor area, sq. ft.	430	430	520	520	520
Max. usable volume, cu. ft.	2,230	2,230	2,680	2,680	2,680
Volume of baggage and freight holds outside cabin, cu. ft.	358(2)	299(2)	370(2)	370(2)	370(2)
Accommodation:					
Normal first-class	40	—	53	52–56	52–56
Normal tourist	48	54	63	65	65
Max. coach	53	65	63	75	75
Powerplants:					
Type and number	4 Dart 510	4 Dart 506	4 Dart 510	4 Dart 525	4 Dart 541
Rated take-off power (I.S.A. at s.l.), e.h.p. and r.p.m.	1,740/14,500	1,540/14,500	1,740/14,500	1,990/15,000	2,350/15,000
Propeller type and diameter	Rotol 4-bl., 10 ft.	Rotol 4-bl., 10 ft.	Rotol 4-bl., 10 ft.	Rotol 4-bl., 10 ft.	Rotol 4-bl., 10 ft.
Weights and Loadings:					
Basic operational weight, lb.	38,326	38,100	40,980	41,276	43,421
Total fuel, lb.	15,736	15,256	15,560	15,256	15,256
Mfrs. max. payload, lb.	11,842	12,500	13,020	15,054	14,079
Max. take-off, lb.	64,500	61,500	64,500	69,000	69,000
Max. landing, lb.	57,500	58,500	58,500	62,000	62,000
Max. zero fuel, lb.	50,168	—	54,000	57,500	57,500
Wing loading, max. t.-o. wt., lb./sq. ft.	67.0	64.0	67.0	71.5	71.5
Wing loading, max. landing wt., lb./sq. ft.	60.0	61.0	60.6	64.5	64.5
Power loading, max. t.-o. wt., lb./e.h.p.	9.25	10.0	9.25	8.67	7.35
Design Limit Speeds:					
Vc, knots E.A.S., 10,000 ft.	235	235	235	264	264
Vne, knots E.A.S., 10,000 ft.	266	273	266	292	292
Vd, knots E.A.S., 10,000 ft.	296	296	296	325	325
Performance:					
Recommended continuous cruising speed, knots	270	266	268	305	341
At altitude, ft./weight, lb.	20,000/57,500	16,500/58,500	20,000/58,500	20,000/62,000	20,000/62,000
At engine r.p.m./with consumption, Imp. gal./hr.	13,800/320	13,800/347	13,800/319	14,000/380	14,200/450
Approach speed (at max. landing weight), knots E.A.S.	115	116	116	119	119
Balanced field length, at max. t.-o. wt., I.S.A. at s.l., ft.	5,310	4,700	5,310	5,550	5,000
I.S.A.+15°C. at s.l., ft.	5,950	5,050	5,850	6,400	5,600
I.S.A. at 5,000 ft., ft.	7,200	6,150	7,200	7,400	6,700
Landing distance from 50 ft. (unfactored) at max. land. wt., ft.	2,920	3,000	2,980	3,300	3,300
Range with max. fuel, t.-o. to landing, no reserves, still air, I.S.A., naut. mi.	1,680	1,660	1,675	1,640	1,680
With payload, lb./fuel, Imp. gal.	10,400/1,967	7,950/1,907	7,560/1,945	10,900/1,907	10,150/1,907
At mean speed, knots/altitude, ft.	271/21,000	274/22,500	271/21,000	296/26,000	298/25,000
Range with max. payload, naut mi.	1,520	1,300	1,040	1,210	1,280

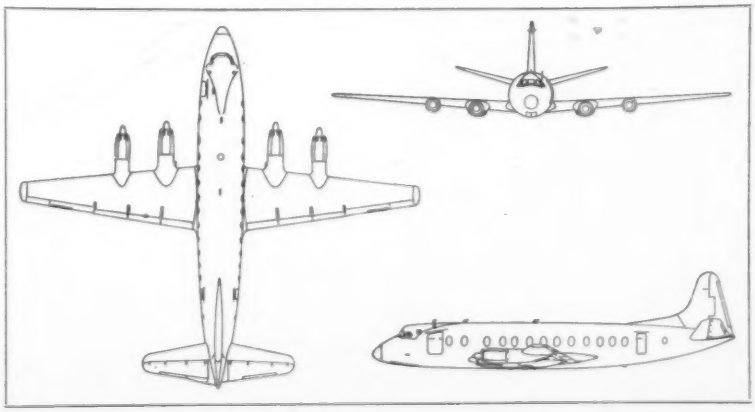
VISCOUNT 700 SERIES ORDERS

Customer	Model	Quantity	Date of first contract announcement	Delivery	Remarks
B.E.A.	701	27	Aug., 1950	July, 1956*	Dart 505/6.
Aer Lingus	707	4	Nov., 1951	April, 1954*	Dart 505/6.
Air France	708	12	Nov., 1951	Aug., 1954*	Dart 505/6.
T.A.A.	720	7	June, 1952	Jan., 1956*	Dart 505/6.
	756	7	April, 1955	1956–1958	Dart 510.
T.C.A.	724	15	Nov., 1952	Feb., 1956*	Dart 506.
	757	36	Aug., 1954	1957–1958	Dart 506.
Hunting-Clan	732	3	May, 1953	July, 1955*	Dart 506.
B.W.I.A.	702	4	June, 1953	Nov., 1955*	Dart 506.
	772	4	June, 1955	Jan., 1958*	Dart 506.
Iraqi Airways	735	3	July, 1953	Dec., 1955*	Dart 506.
	773	1	Mar., 1956	Nov., 1957	Dart 506.
Indian Air Force	723	1	Nov., 1953	Dec., 1955	Dart 506. V.I.P. interior.
	730	1	Nov., 1953	Jan., 1956	Dart 506. V.I.P. interior.
Airwork	736	2	Jan., 1954	Dec., 1955*	Dart 506. Bought from Fred Olsen.
Fred Olsen	779	4	June, 1955	Aug., 1957*	Dart 510. Leased to Austrian Airlines.
Misrair	739	3	Mar., 1954	Jan., 1956*	Dart 506.
	739A	2	Dec., 1956	1958	Dart 506. Variant of 739.
Canadian D.O.T.	737	1	April, 1954	Mar., 1955	Dart 506.
	745	1	April, 1958	April, 1958	Dart 510.
L.A.V.	749	3	May, 1954	Mar., 1956*	Dart 506.
Butler	747	2	June, 1954	Sept., 1956*	Dart 506.
Capital Airlines	745	60	Aug., 1954	1958	Dart 510. Original deliveries completed March, 1957.
	744	3	June, 1954	July, 1955	Now out of service.
C.A.A.	748	5	July, 1954	July 1956*	Dart 510.
Hong Kong Airways	760	2	Oct., 1954	Feb., 1957*	Dart 510.
Icelandair	759	2	Nov., 1954	Dec., 1956*	Dart 510. Originally ordered by Hunting-Clan.
Pakistan Govt.	734	1	Mar., 1955	April, 1956	Dart 506 V.I.P. interior.
Union of Burma	761	3	May, 1955	Oct., 1957*	Dart 510.
U.S. Steel	764	3	June, 1955	Dec., 1956*	Dart 510. Executive.
Standard Oil	765	1	June, 1955	Feb., 1957*	Dart 510. Executive.
M.E.A.	754	7	June, 1955	Jan., 1958*	Dart 510.
Hughes Tool	763	1	June, 1955	—	Dart 510.
Indian Air Lines	768	10	July, 1955	June, 1958*	Dart 510.
Cubana	755	3	Dec., 1955	June, 1956*	Dart 510. Originally ordered by Airwork.
Iranian Govt.	782	3	Mar., 1956	May, 1958*	Dart 510.
P.A.L.	784	2	April, 1956	Sept., 1957*	Dart 510. One on lease to TACA.
S. African Govt.	781	1	May, 1956	June, 1958*	Dart 510. V.I.P. interior.
Alitalia–L.A.I.	785	10	May, 1956	June, 1958*	Dart 510.
Kaysam Invest. Corp.	786	1	Sept., 1956	Aug., 1957	Dart 510. Originally ordered by Lloyd Aereo Colombiano.
Brazil Govt.	742	1	Sept., 1956	Nov., 1956	Dart 510. Originally ordered by Braathens.
	789	1	Sept., 1956	1957	Dart 510.
PLUNA	769	3	Sept., 1956	June, 1958*	Dart 510.
LANICA	786	2	Sept., 1956	Feb., 1957*	Dart 510. Originally ordered by Lloyd Aereo Colombiano.
Turkish Airlines	794	5	July, 1957	Feb., 1958	Dart 510.

VISCOUNT 800, 806 and 810 ORDERS

Customer	Model	Quantity	Date of first contract announcement	Delivery	Remarks
B.E.A.	802	24	Feb., 1953	Sept., 1957*	Dart 510
K.L.M.	803	9	June, 1955	Dec., 1957*	Dart 510.
Transair	804	3	June, 1955	April, 1958*	Dart 510.
N.Z.N.A.C.	807	3	Nov., 1955	Dec., 1957–1958	Dart 510.
Aer Lingus	808	6	Dec., 1955	1958–1959	Dart 510.
Eagle Aviation	805	2	May 15, 1957	Mar., 1958*	Dart 510.
B.E.A.	806	18	Jan., 1956	1957–1958	Dart 520.
Continental	812	15	Dec., 1955	May, 1958	Dart 525.
S.A.A.	813	7	March, 1956	1958	Dart 525.
Lufthansa	814	9	May, 1956	1958	Dart 525.
P.I.A.L.	815	3	May, 1956	1958	Dart 525.
Cubana	818	4	June, 1956	1958	Dart 525.
Niarchos	819	1	Nov., 1956	1958	Dart 525.
V.A.S.P.	827	5	May, 1957	Mid–1958	Dart 525.
Airwork	831	2	April 10, 1958	Late 1958	Dart 525.
Ansett/A.N.A.	832	4	May 23, 1958	Early, 1959	Dart 525.
Hunting Clan	833	3	May 29, 1958	Early, 1959	Dart 525.

* Date of completion of delivery.



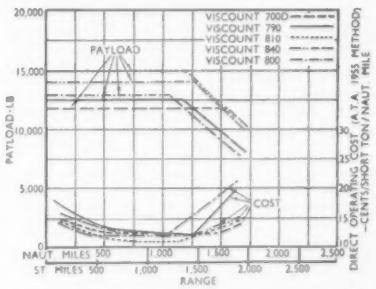
short sectors without intermediate refuelling and with full reserves remaining for the final sector. It is powered with Dart 506s with high-activity propellers for good take-off performance. In normal form the 790 seats 54 passengers, with possible layouts for up to 65 passengers. Integral airsteps at the forward door are standard.

The 800 Series (type numbers 802-809—excluding the 806, which is a special B.E.A. variant) have a fuselage which is 46 in. longer than the 700 and has an extra 108 in. of available interior length. The cabin capacity is from 53 to 65 passengers. Aircraft in the series were powered with Dart 510s; the 806 alone has the Dart 520.

The major developments in the 800 Series are the 810 and 840 Series. The 810 is powered with Dart 525s which are de-rated to 1,800 s.h.p. for take-off and give full power up to I.S.A. +6° C. at sea level without water injection. The used (or available) type numbers are 810-839. When powered in due course with Dart 541s, the 810 becomes the 840 (type numbers 841 and upward). These engines, de-rated to 2,100 s.h.p. for take-off, not only provide maximum "dry" power up to I.S.A. +10° C. at sea level, but give a continuous cruising power which makes the 840 a 400-m.p.h. aircraft.

The 810/840 may or may not be the ultimate development of the Viscount, but it is, at any rate, the result of 10 years' experience with a basic type. The first in the Series are the 812s for Continental Airlines. Vickers' own 810/840 made its first flight just before Christmas last year and the first 812 for Continental flew on February 14 this year. The type has, in effect, the capacity of the originally short-haul 800 with a higher speed and much the range performance of the developed 700s. By detail re-design both the take-off weight and the limiting airspeeds have been substantially increased on those for previous variants.

The principal production centre for the 700s is at Hurn, near Bournemouth, Hampshire. The 800s are produced at Vickers' Weybridge factory.



VISCOUNT 810/840

Structure: Single-spar wing, with two subsidiary spanwise members to complete torsion box. Built up in five spanwise sections. Semi-monocoque fuselage with large equi-stress elliptical window cut-outs.

Undercarriage: Twin-wheel tricycle with steerable nose-wheel.

Flaps: Double-slotted forward-retracting type, in six sections, electrically operated.

Flying Controls: Manually operated by push-pull rods.

Systems: Duplicated hydraulic system, at 2,000–2,500 p.s.i., operates undercarriage, nose-wheel steering and wheel-brakes. Electrical supply from four 9 kW. generators. Cabin air, at 6.5 p.s.i., supplied from three engine-driven blowers and cooled by turbo-expander and air-cycle refrigeration. De-icing of wing and tail surfaces by hot air from engine heat-exchangers; electrical propeller and intake de-icing.

Commercial Aircraft . . . .

The Vickers 950 Vanguard

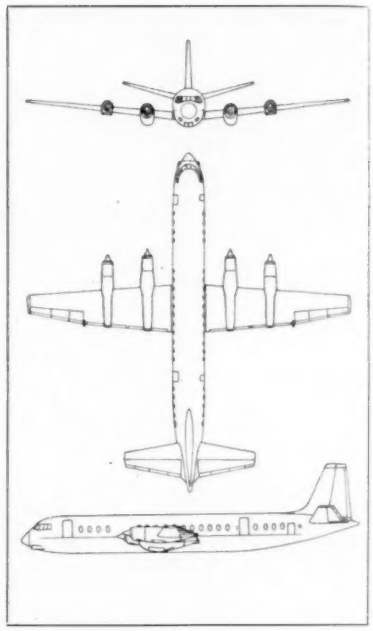
ORIGINALLY planned (as the V.900) to meet a specification to B.E.A.'s particular requirements, the V.950 Vanguard was further developed in its design stages to match the likely needs of other World operators. The Corporation's seasonal and other traffic problems were among those which called for the layout which is a unique feature of the Vanguard—the ability to carry a full passenger payload with ample volumetric and weight capacity for freight, or, without time-consuming modifications, to carry a near-maximum payload of cargo, so that passenger and freight payloads are, in effect, interchangeable during turnround.

The first announcement of the Vanguard was made in November, 1955, and a fuller statement about the developed specification was made in May, 1956. It is entirely a private venture of Vickers-Armstrongs and the first aircraft (from production jigs at Weybridge) is due to fly during the last quarter of this year. The second Vanguard from the lines is now undergoing structure and fatigue tests and the third aircraft will join the first in 1959 on development, certification and proving work. Altogether, five aircraft from the production line will be used for development and B.E.A. are due to receive their first 951 early in 1960. Delivery of Trans-Canada Airlines' 952s will also start late in 1960 for introduction into service on the 1961 summer schedules.

The Vanguard now offered to operators is based on the 952 for T.C.A. and the type has, from the start, been designed to conform to U.S. and to U.K. standards of airworthiness. The upper floor of the double - bubble - section fuselage is arranged to accommodate 97 (five-abreast)—139 (six-abreast)—passengers in three compartments. The under-floor compartment consists of two freight holds with a total capacity of 1,360 cu. ft. and with large doors and adequate working space.

The first series of aircraft will be initially powered by Rolls-Royce Tyne 505s (R.Ty.1) of 4,795 e.h.p. Later aircraft will have the R.Ty.11 engines rated at 5,380 e.h.p. and rising to more than 5,500 s.h.p. in subsequent development stages. The performance figures in the table are for the Vanguard Mk. 2 and assume the use of the initially developed version of the R.Ty.11. The payload of this Vanguard has been increased on that for the earlier version without, however, any increase in maximum gross weight.

The production line for the Vanguard is in the main assembly shop at Weybridge, where the first of the Vanguards followed the last of the Valiants. Detail fabrication is in progress at both Weybridge and Hurn. Number One is due to be rolled out in September this year and will fly in October or November. The first for B.E.A.—following the aircraft



Dimensions
Span: 118 ft. 0 in.
Overall length: 122 ft. 10.4 in.
Overall height: 34 ft. 11 in.
Gross wing area: 1,529 sq. ft.
Sweepback: Nil.
Internal cabin dimensions:
Length (ex. flight deck): 90 ft. 0 in.
Max. width: 127 in.
Max. height: 86.5 in.
Max. usable floor area (ex. flight deck): 893 sq. ft.
Max. usable volume (ex. flight deck): 5,690 cu. ft.

Accommodation
Normal first-class: 97 (5 abreast)
Normal mixed: 114 (5 abreast)
Max. coach: 139 (6 abreast)
Volume of freight and baggage holds: 1,360 cu. ft. (2).

Structure: Torsion-box wing. Three shear webs with integrally machined upper and lower skin-stringer panels. Centre-section structure built into lower half of double-bubble fuselage. Torsion-box provides tip-to-tip integral tankage.

Undercarriage: Twin-wheeled tricycle. Steerable nose-wheel. All forward-retracting and designed for free fall.

Flaps: Constant-chord Fowler-type, four sections per side.

Flying Controls: Manually operated through push-pull rods with aerodynamic balance and spring tabs.

Systems: Duplicated hydraulic system (3,000 p.s.i.) operates undercarriage, flaps, wheel-brakes, nose-wheel steering, propeller brakes and airsteps. Electrical supply from four variable-frequency alternators providing AC power for de-icing propellers, cowls and spinners; remainder provides 28-V.DC via four transformer/rectifier units. Additional alternators on numbers one and four powerplants provide power for tail unit and windscreen de-icing. Wing de-icing by engine heat exchangers. Cabin air, at 6.5 p.s.i., supplied by blowers on inboard powerplants.

VANGUARD ORDERS

Customer	Quantity	Option	Announced value	Date of contract announcement	Delivery begins	Remarks
B.E.A.	20	10	—	July 20, 1956 ..	1960	Type 951
T.C.A.	20	4	$67.1m.	Jan. 3, 1957 ..	1960	Type 952

Powerplants
Four Rolls-Royce Tyne R.Ty. 11.
Take-off power each (I.S.A., s.l.): 5,525 e.h.p. at 15,250 r.p.m.
de Havilland four-blade reversing propellers 14 ft. 6 in. diameter.

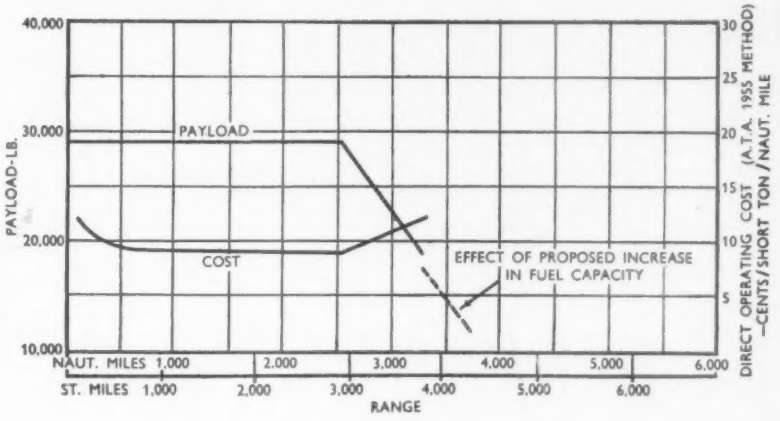
Weights and Loadings
Basic operational: 83,500 lb.
Total fuel: 40,800 lb.
Mfrs. max. payload: 29,000 lb.
Max. take-off: 141,000 lb.
Max. landing: 121,000 lb.
Max. zero fuel: 112,500 lb.
Wing loading (max. t-o. wt.): 92.2 lb./sq. ft.
Wing loading (max. landing wt.): 79.2 lb./sq. ft.
Power loading (max. t-o. wt.): 6.37 lb./e.h.p.

Design Criteria
Design limits at 10,000 ft.: Vc=313 k. Vne=352 k. Vd=391 k.

Performance
Recommended cont. cruising speed (I.S.A.): 367 knots (at 20,000 ft. and 121,000 lb.); consumption: 710 Imp. gal./hr.; power: 13,500 r.p.m.
Approach speed (at max. landing wt.): 127 knots E.A.S.
Balanced field lengths (at max. t-o. wt.): At I.S.A. at sea level: 6,000 ft.
At I.S.A. +15°C. at sea level: 7,300 ft.
At I.S.A. at 5,000 ft.: 8,200 ft.
Landing distance from 50 ft. (unfactored, max. landing wt.): 3,300 ft.
Range (take-off to landing), still air, no reserves, I.S.A., max. fuel (5,100 Imp. gal.): 3,300 naut. mi. with 19,100 lb. payload at 350 knots (mean) at 30,000 ft. (mean).
Range (take-off to landing) still air, no reserves, I.S.A., with max. payload 2,540 naut. mi. at 343 knots at 30,000 ft.

Commercial Aircraft . . . .

now being structure-tested—will be rolled out in December and will be followed during 1959 by three other B.E.A. aircraft which will take their part in a flight development and certification test programme involving 1,000 hours in the air. A full C. of A., following tropical and winterization trials as well as normal temperature testing, is expected during the December-March period 1959-60 and the aircraft will enter service with B.E.A. in 1960.



The Scottish Aviation Twin Pioneer

THE 16-passenger Twin Pioneer is a natural development of the single-engined Pioneer and use is made in the design and construction of the experience gained with its antecedent. Its development was the result of an evident need for a light transport aircraft suitable for operation from roughly prepared terrain yet having the advantage of engine-out capabilities—and even, when necessary, capable of meeting transport category performance requirements.

The Twin Pioneer is conventional in structure and has a fixed undercarriage with a tail-wheel layout, but has the high-lift devices (slats and flaps) developed in the Pioneer. The prototype made its first flight on June 25, 1955, and this was followed by three pre-production aircraft, all of which had flown by the end of 1956.

Orders and deliveries so far number about 55, including 32 for the R.A.F. Apart from executive-user, Government and club purchasers, Twin Pioneers have been ordered (or are in service with) the following operators: de Kroonduif, New Guinea (3); Borneo Airways (2); Philippine Air Lines (5); Fison-Airwork (2); and Scottish Airlines (1). The aircraft for the Philippines are powered with Twin Wasp engines, the first of this version being about to start its flight trials at Prestwick.

Dimensions
Span: 76 ft. 6 in.
Overall length: 45 ft. 3 in.
Overall height: 12 ft. 3 in.
Gross wing area: 670 sq. ft.
Sweepback: Nil.
Internal cabin dimensions:
Length (ex flight deck): 22 ft. 8 in.
Max. width: 72 in.
Max. height: 69 in.
Max. usable floor area (ex flight deck): 112.5 sq. ft.

Accommodation
Normal: 16.
Volume of freight and baggage holds 34 cu. ft.

Structure: All-metal, strut-braced two-spar high wing. Basically square section semi-monocoque, two-section fuselage.

Undercarriage: Fixed twin-wheel main units and tail wheel.

Flaps: Fowler-type in four sections interconnected with leading-edge slats outboard of engines.

Air Brakes: None.

Flying Controls: Manually operated. Built-in lock.

Systems: Hydraulics at 2,500 p.s.i. from two engine-driven pumps and accumulators operate flaps, slats and brakes. Emergency by reserve accumulators and air bottle. Two 4.5-kW DC generators supplying 28-V system. 175 gal. fuel in four bag tanks.

Powerplants
Two Alvis Leonides.
Take-off power each (I.S.A., s.l.): 540 b.h.p. at 3,000 r.p.m.

Weights and Loadings
Basic operational: 9,502 lb.
Total fuel: 1,296 lb.
Mfrs. max. payload: 3,258 lb.
Max. take-off: 13,500 lb.
Max. landing: 13,500 lb.
Max. zero fuel: No restriction.
Wing loading (max. t-o. wt.): 20.1 lb./sq. ft.

Wing loading (max. landing wt.): 20.1 lb./sq. ft.
Power loading (max. t-o. wt.): 12.7 lb./b.h.p.

Performance
Recommended cont. cruising speed (I.S.A.): 102 knots (at 5,000 ft. and 13,500 lb.); power (per engine): 48% METO.
Approach speed (at max. landing wt.): 68 knots.
Distance to 50 ft. plus 25% (I.S.A., s.l.): 1,272 ft.
Landing distance from 50 ft. (unfactored, max. landing wt.): 1,170 ft.
Range (take-off to landing), still air, no reserves, I.S.A., max. fuel (247 Imp. gal.): 795 naut. mi. with 1,850 lb. payload at 102 knots (mean) at 5,000 ft. (mean).
Range (take-off to landing), still air, no reserves, I.S.A., with max. payload: 50 naut. mi.

The Boeing 707

Commercial Aircraft . . . .

BOEING are continuing to make fast progress with the 707 which, in the space of the next week or two, is expected to become the first U.S. turbojet aircraft to be certificated by the C.A.A. Since the first production 707 flew on December 20, several days ahead of schedule, this progress has been more than maintained, and the target date for completion of certification flying has been moved forward to July 18. Allowing for completion of the necessary paperwork, the actual certificate should be in hand by August and P.A.A. are proceeding quietly with their plans to have the type in service on the North Atlantic in November.

Production is also well ahead, and Boeing plan to deliver six 707-120s to P.A.A. before the end of this year, compared with their contractual commitment to deliver one. These will be followed by six -120s for American Airlines, with the first long-fuselage -320 for P.A.A. next on the line in No. 13 position. Up to the end of May, Boeing had flown three -120s, of which the second had gone to Edwards Air Force Base for take-off and landing trials and the first and third were flying from Boeing Field in Seattle. These three aircraft had flown a total of 320 hours while the old 367-80 prototype had totalled 933 hours by June 2.

All production of the Boeing 707 is handled at the company's Transport Division at Renton, near Seattle, together with that of the KC-135 tanker transport. Up to the final assembly line, commercial and military models are treated in common, although they now differ in many respects, including basic fuselage diameter. At the end of the mate line, where the front fuselage and wing are joined, the aircraft move on to one of two U-shaped final assembly lines, respectively for KC-135s and 707s. The KC-135 will this month achieve peak production rate of 15 aircraft a month, while the Boeing 707 line is designed to handle up to 10 a month in addition.

The extent to which Boeing's calculated gamble, in building a prototype jet tanker-transport as a private venture, paid off is now widely known. The existing orders for 336 KC-135s (with prospects of several hundreds more) have kept tooling and development costs on the 707 to a minimum, although the big 320 model, especially, is very different from the KC-135. Military approval for the type was further signified recently with an order for three 707-120s to be operated by the U.S.A.F. (with the designation VC-137) as Presidential and D.V. (distinguished visitor) transports.

Boeing philosophy, unlike that at Santa Monica, has been to offer a wide range of dimensionally different aeroplanes having similar aerodynamic characteristics. Thus there are now at least six variants on order involving three fuselage lengths, two wing areas and three powerplants. The basic 707 Stratoliner configuration, and that which will be first certificated, has a weight of not less than 247,000 lb. and JT-3C engines. This is available with standard or short fuselage, the Qantas order being for aircraft of

BOEING 707

Structure: Two-spar wing in two main units joined by a fuselage-width centre section. Integral wing tanks and bag tank in centre section. Double-bubble monocoque fuselage.

Undercarriage: Four-wheel bogie main units, inward retracting, and twin-wheel steerable nose-wheel. Hydraulic brakes.

Flaps: Double slotted in two portions on each wing.

Air Brakes: Two spoilers above and below each wing, and u/c up to 320 knots I.A.S.

Flying Controls: Aerodynamically-balanced manual low-speed ailerons and separate high-speed ailerons with differential spoilers. Aerodynamically balanced manual rudder and elevators, with hydraulic rudder boost for large angles. Electrically v.i. tailplane.

Systems: Duplicated 3,000 p.s.i. hydraulic system for u/c, wheel brakes, flaps, spoilers, nose-wheel steering and windscreen wipers. Four 30 kVA three-phase alternators generating at 115V, with rectifiers for 28V DC requirements, and 36 amp.-hr. battery. Cabin pressurization 8.6 p.s.i. by three turbocompressors driven by engine compressed air. De-icing of wing and engine intakes by turbine-bled air; electric mats on tailplane; Nesa-glass windscreen. Two-point pressure refuelling at 1,500 g.p.m.

BOEING 707-120 ORDERS

Customer	Quantity	Option	Announced value	Date of contract announcement	Delivery begins	Remarks
Pan American	6	—	—	Oct. 13, 1955	Aug., 1958	Model 121. See also 707–320
American Airlines ..	30	—	$135m.	Nov. 9, 1955	Dec., 1958	Model 123
Continental	4	—	$21.3m.	Dec. 12, 1955	May, 1959	Model 124
T.W.A.	15	—	—	Feb. 7, 1956	April, 1959	Model 131. See also 707–320
Qantas	7	—	—	Sept. 6, 1956	May, 1959	Model 138
Cubana	2	—	$11m.	June 10, 1957	Mar., 1960	Model 139
U.S.A.F.	3	—	—	May 14, 1958	1959	Model 150 (VC–137)

BOEING 707-220 ORDERS

Braniff	5	—	$30m.	Dec. 1, 1955	Oct., 1959	Model 227

BOEING 707-320 ORDERS

Pan American	17	—	$135m.	Feb. 23, 1956	Sept., 1959	Model 321. Value includes 6 Model 120
Air France	17	—	—	Dec. 28, 1955	Nov., 1959	Model 328
Sabena	4	—	$20.7m.	Dec. 28, 1955	Dec., 1959	Model 329
T.W.A.	18	—	—	—	—	Model 331
S.A.A.	2	—	—	Feb. 21, 1958	July, 1960	Model 344

BOEING 707-420 ORDERS

Lufthansa	4	—	$21m.	April 24, 1956	Jan., 1960	Model 430
Air India	3	—	$23.26m.	Aug. 31, 1956	Jan., 1960	Model 437
B.O.A.C.	15	—	$98m.	Oct. 24, 1956	Dec., 1959	Model 436
Varig	2	—	$20m.	Sept. 6, 1957	July, 1960	Model 441

BOEING 720 ORDERS

United	11	19	$39.7m.	Nov. 22, 1957	April, 1960	Model 022

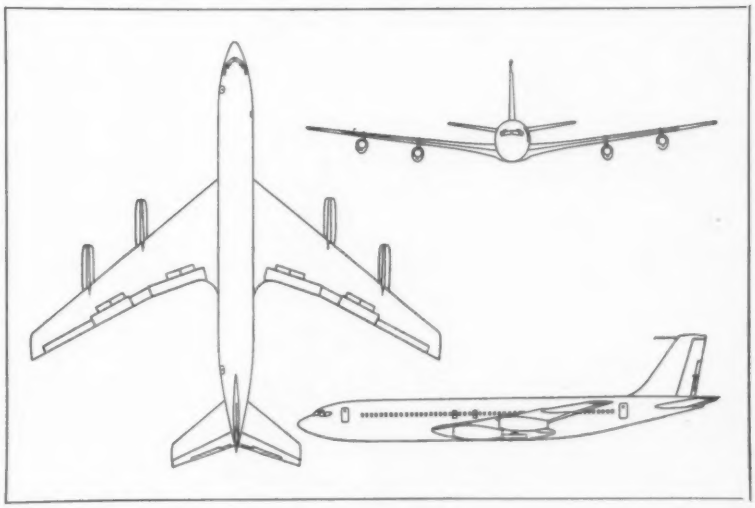
	720-020	707-120	707-220	707-320	707-420
Dimensions:					
Wing Span, ft. in.	130 10	130 10	130 10	142 5	142 5
Overall length, ft. in.	136 2	144 6	134 6	146 3	146 3
Overall height, ft. in.	38 7	38 5	38 3	38 3	38 8
Gross wing area, sq. ft.	2,433	2,433	2,433	2,892	2,892
Sweepback, deg. in 25% M.A.C.	35°	35°	35°	35°	35°
Internal cabin dimensions, ex. flight deck: length, ft. in.	96 4	104 8	94 8	104 8	104 8
Max. width, in.	139	139	139	139	139
Max. height, in.	90.9	90.9	90.9	90.9	90.9
Max. usable floor area, sq. ft.	907	1,077	930	1,077	1,077
Max. usable volume, cu. ft.	5,950	6,481	5,846	6,481	6,481
Volume of baggage and freight holds outside cabin, cu. ft.	1,285 (2)	1,600 (2)	1,290 (2)	1,500 (2)	1,500 (2)
Accommodation:					
Normal first class	110	121	110	121	121
Normal tourist	131	143	131	143	143
Max. coach	168	177	168	177	177
Powerplant:					
Type and number	4 JT-3C-7	4 JT-3C-6	4 JT-4A-3	4 JT-4A-3	4 Conway 505
Rated take-off power (i.s.a. at s.l.) lb.s.t.	12,000 (dry)	13,000 (wet)	17,000* (dry)	17,000* (dry)	16,500 (dry)
Weights and loadings:					
Basic operational weight, lb.	104,500	114,500	117,500	129,500	128,000
Total fuel, lb.	87,607	113,087	113,087	153,270	153,270
Mfr.'s max. payload, lb.	32,855	42,433	33,964	40,000	40,000
Max. take-off, lb.	212,000	247,000	247,000	295,000	295,000
Max. loading, lb.	165,000	175,000	175,000	195,000	195,000
Max. zero fuel, lb.	136,000	165,000	165,000	177,500	177,500
Wing loading, max. t-o. wt., lb./sq. ft.	87.14	101.52	101.52	102.0	102.0
Wing loading, max. landing wt., lb./sq. ft.	67.81	71.93	71.93	67.43	67.43
Power loading, max. t-o. wt., lb./lb. s.t.	4.86	4.75	3.63*	4.33*	4.4
Design limit speeds:					
Mc/Vc, (knots E.A.S.)	.90 (375 k.)	.88 (360 k.)	.88	.88	.88 (360 k.)
Mne/Vne (knots E.A.S.)	.90 (375 k.)	.895	.895	.88	.88
Md/Vd, (knots E.A.S.)	—	.94 (425 k.)	.94 (425 k.)	.94	.94 (425 k.)
Performance:					
Cruising speed, long range cruise to Vno, knots	466–532	457–514	454–528	458–526	457–527
At altitude, ft.	40,000–22,000	40,000–22,500	40,000–24,000	40,000–24,000	40,000–24,000
At weight, lb.	155,000	170,000	170,000	190,000	190,000
Approach speed (1.3 Vso), knots	127	135	135	130	130
Balanced field length, at max. t-o. wt., I.S.A. at s.l., ft.	7,500	9,600	6,900	8,700	8,600
I.S.A. +15°C. at s.l., ft.	9,280	10,392	8,200	10,600	10,600
I.S.A. at 5,000 ft., ft.	11,100	—	9,530	12,600	12,000
Landing distance from 50 ft. (unfactored) at max. land. wt., ft.	3,288	3,780	3,780	3,840	3,840
Range with max. fuel, t-o. to landing, no reserves, still air, I.S.A., naut. mi.	4,190	4,805	4,930	6,252	6,290
With payload, lb./fuel, Imp. gal.	21,200/11,223	16,700/14,487	3,780/14,487	13,000/19,635	14,700/19,635
At mean speed, knots/altitude, ft.	454/38,000	460/38,000	454/38,000	458/37,000	457/37,000
Range with max. payload, naut. mi.	3,520	3,400	3,980	4,820	4,910

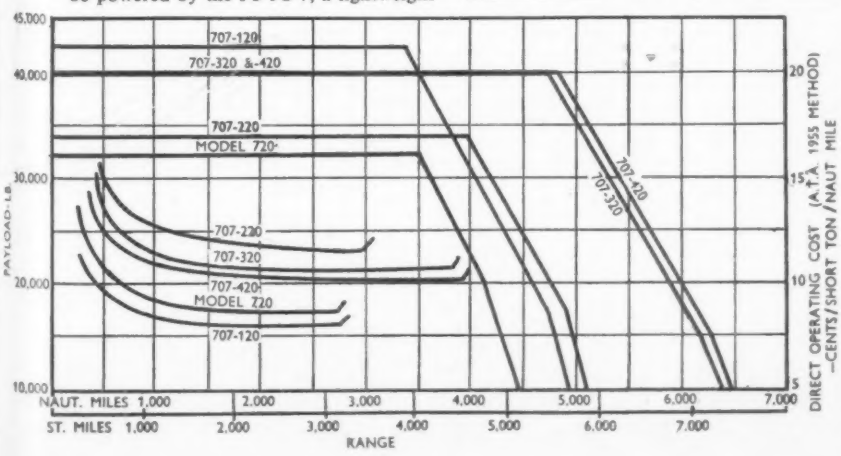
* Approximate figures.

the latter type. The same basic aeroplane is also offered with JT-4A engines and has been ordered in this -220 form by Braniff, who need the extra power for take-offs at high altitudes and temperatures.

The big-wing 707 Intercontinental will weigh not less than 298,000 lb. and is available with JT-4A (-320) or Conway (-420) engines. It has increased wing span, bigger fuel capacity and longer fuselage than the standard -120 and is now in process of being further modified to carry still more fuel, taking the gross weight over 300,000 lb. Certification of the -320 is expected by the middle of next year, and of the -420 before the end of 1959.

Smallest in the range is the 720-020, a variant once known as the 707-020 and intermediately as the 717. Having the same dimensions as the smallest 707-120 (i.e., the Qantas model) the 720 has a lower gross weight of 212,000 lb. and smaller fuel capacity, being aimed at the medium-haul market. Initially, this will be powered by the JT-3C-7, a lightweight



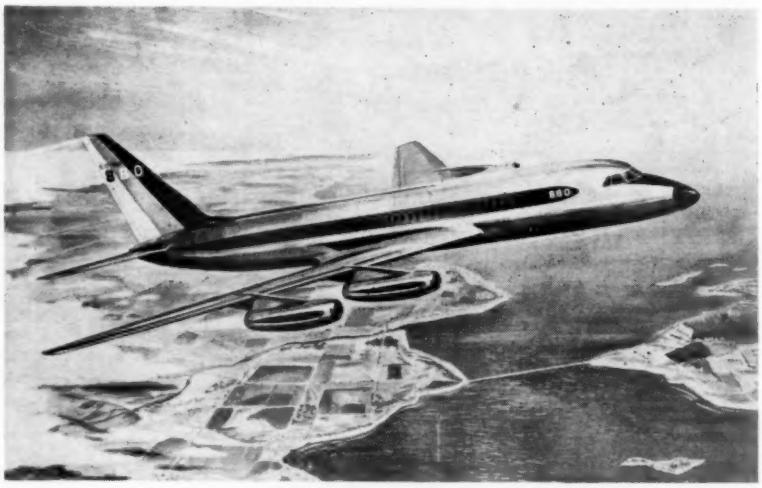


version of the Pratt and Whitney JT-3 engine rated at 12,000 lb. dry and offering a marked saving in weight and in fuel consumption. Boeing are continuing to study the application of other engines to the 720 and report that the "turbofan" engines now in development look very promising in this connection.

Boeing have themselves undertaken development of suppressors and reversers for the Pratt and Whitney engines in the 707, and will use a 21-tube exhaust nozzle with the reversers located upstream. The reversers themselves are conventional clam-shell type, deflecting the jet stream through two side orifices in which closely spaced vanes control the direction of the exhaust closely to prevent interference between pods and fuselage. Rolls-Royce equipment will be used on the Conway-engined 707-420s.

Commercial Aircraft . . . .

The Convair 880



THE Convair 880 was the third of the current trio of U.S. turbojet transports and was designed primarily for U.S. domestic operations, where very long ranges were not required. This basic medium-range domestic version was ordered by T.W.A. and Delta in the autumn of 1956 and Convair proceeded to put the type into production. The company was a little more ambitious than Boeing and Douglas so far as performance is concerned, designing for an M_0 of 0.89 (equal to a cruising speed of 615 m.p.h. at 25,000 ft.)

Convair chose to base their design on the General Electric J79 turbojet, which was lighter than the Pratt & Whitney J57. The initial versions of the Convair 880 (the actual Convair design number is Model 22) will have four CJ-805-3 turbojets rated at about 10,500 lb. each, but alternative arrangements are being considered. A layout has been prepared for one prospective customer using the CJ-805-21 turbine engine and this version could be offered from March 1961 onwards. Performance studies have been completed also based on the Rolls-Royce Avon Stage IIIA offering more than 13,000 lb.s.t. and Convair are prepared to offer firm dates and specifications for this model if requested by a potential purchaser.

The CV-880 will be certificated at a basic weight of 178,500 lb. in the domestic version. Also available is a long-range or international version which has a 1,665-Imp.-gallon centre-section fuel tank and gross weight increased to 186,500 lb, without alteration to the landing or zero fuel weights. Another configuration studied has a gross weight of 199,400 lb., when the max. landing weight becomes 155,000 lb., zero fuel weight is 124,500 lb., and structural payload limit is 35,820 lb. Convair have also been studying a version with a larger wing (area 2,350 sq. ft.) and bigger fuel capacity.

Certification target date is March 1960, by which time ten aircraft should be complete, including three used in the C.A.A. programme, one in structural test and six for T.W.A. and Delta proving and familiarization flying. The first CV-880 is scheduled to be rolled out in December,

Dimensions
Span: 120 ft. 0 in.
Overall length: 129 ft. 4 in.
Overall height: 36 ft. 0 in.
Gross wing area: 2,000 sq. ft.
Sweepback: 35° at 25% M.A.C.
Internal cabin dimensions:
Length (ex. flight deck): 89 ft. 3 in.
Max width: 128 in.
Max. height: 85 in.

Accommodation
Normal first-class: 84 (4 abreast).
Normal tourist: 109 (5 abreast).
Max. coach: 147 (6 abreast).
Volume of freight and baggage holds: 865 cu. ft. (in two holds).

Structure: Three-spar wing assembled in one piece. Integral fuel tanks between spars. Semi-monocoque elliptical-section fuselage.

Undercarriage: Four-wheel main bogies, inwards retracting. Twin-wheel steerable nose-wheel, forward retracting. Hydraulic brakes on main and nose gear.

Flaps: Double-slotted Fowler-type in three pieces each side.

Air Brakes: Four upper-wing spoilers ahead of flaps and u/c up to Vc.

Flying Controls: Fully manual inboard ailerons with servo tabs, in conjunction with differentially operated spoilers through Convair "mixing box." Manual rudder and elevator with servo tabs; hydraulic v.i. tailplane.

Systems: Duplicated 4,000-lb. hydraulic system for flaps, u/c, spoilers, tailplane, brakes and nose-wheel steering. Three 40 kVA engine-driven generators provide 115/208V 400-cycle AC plus four rectifiers for 28V DC; 24V DC battery. Cabin pressurization at 8.2 p.s.i. from two turbo-compressors driven by engine compressed air. De-icing of wing and intakes by engine-bleed air; electric tail unit de-icing; Nesa-glass windscreen and air-blast rain removal. Four-point pressure refuelling at 1,000 gal./min.

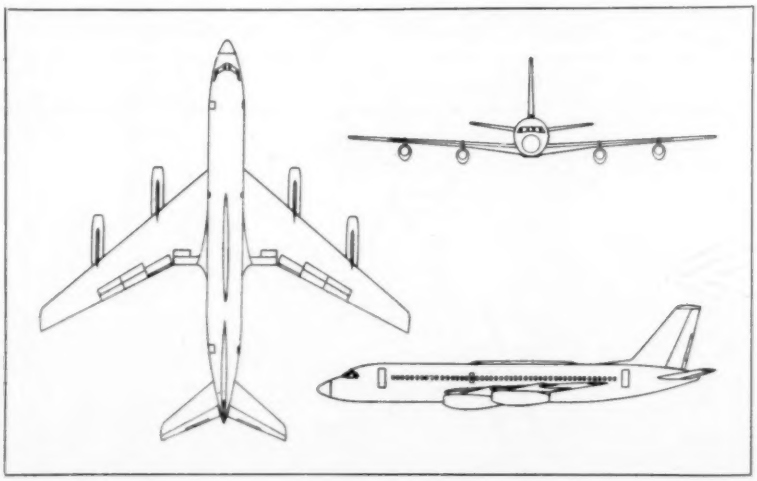
Powerplants
Four General Electric CJ-805-3.
Take-off power each (I.S.A., s.l.): 11,000.*
Provision for suppressors and reversers.

Weights and Loadings
Basic operational: 86,200 lb.
Total fuel: 72,159 lb.
Mfrs. max. payload: 30,800 lb.
Max. take-off: 178,500 lb.
Max. landing: 130,000 lb.
Max. zero fuel: 113,000 lb.
Wing loading (max. t-o wt.): 89.25 lb./sq. ft.
Wing loading (max. landing wt.): 65.0 lb./sq. ft.
Power loading (max. t-o. wt.): 4.06 lb./lb.*

Design Criteria
Design limits: Mc=0.89.

Performance
Recommended cont. cruising speed (I.S.A.): 506 knots (at 25,000 ft. and 135,000 lb.); power (per engine): 90% max. cruise.
Balanced field lengths (at max. t-o. wt.):
At I.S.A. at sea level: 6,900 ft.
At I.S.A.+15°C. at sea level: 8,400 ft.
At I.S.A. at 5,000 ft.: 9,750 ft.
Landing distance from 50 ft. (unfactored, max. landing wt.): 5,900 ft.
Range (take-off to landing), still air, no reserves, I.S.A., max. fuel (8,970 Imp. gal.): 3,745 naut. mi. with 20,800 lb. payload at 430 knots (mean) at 35,000 ft. (mean)..
Range (take-off to landing), still air, no reserves, I.S.A., with max. payload: 3,390 naut. mi.

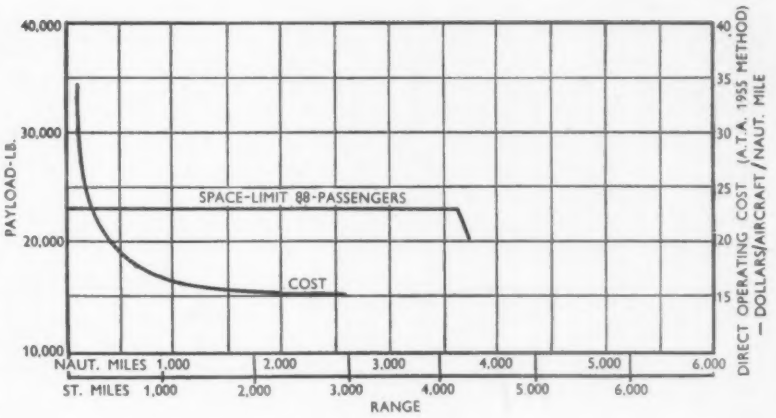
* Approximate figures.



1958, and flown on January 30, 1959; the third machine is destined for structural testing and the fifth should be ready for handing over to T.W.A. in November 1959.

Production rate will pick up from one a month at the end of next year to six a month by July 1960—the peak rate planned at present. All aircraft are being built on production jigs and the three certification trials aircraft and the structural test specimen will in due course be fed back through the line for standardization and delivery to T.W.A. or Delta. An extra fuselage and stub wing is to be built early on in the production sequence and will be used for water tank fatigue testing.

Convair estimate the break-even point on the CV-880 to be about 150 aeroplanes, at a basic selling price of $3.5 million each. To date, the company has firm orders for 40, with another eight to be bought by two South American operators subject to satisfactory financing, and up to 15 to be bought by Capital Airlines. At the time of writing, these latter orders have not reached the point where production of the aircraft would actually be started. Convair investment in the CV-880 programme is about $100 million so far, including $30 million for tooling, $10 million for engineering and $5 million for new machine tools and workshop equipment.



CONVAIR 880 ORDERS

Customer	Quantity	Option	Announced value	Date of contract announcement	Delivery	Remarks
T.W.A.	30	—	$150m.	Sept. 10, 1956	Nov., '59–Sept., '60	Model 22–1.
Delta	10	—	$50m.	Sept. 10, 1956	Jan., '60–Sept., '60	Model 22–2.
Transcontinental, S.A.	4	—	—	Mar. 1, 1957	1960	Subject to financial arrangements.
REAL Aerovias ..	4	—	$17.5m.	July 1, 1957	1960	
Capital	9	6	$60m.	Jan., 1958	1960	Subject to confirmation

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Convair Conversions

OF all the various proposals to convert existing piston-engined transports to turboprop power, those based upon the Convair series of twin-engined aircraft have so far proved the most practicable. This is partly because Convair designed their original 240 with the possibility of turboprop variants in mind and partly because large numbers of Convairs have now been in airline service long enough to have been almost fully depreciated and are therefore "ripe" for conversion.

The earliest Convair turboprop conversion was by Allison Division of General Motors, who fitted two of their T38 engines in a Convair 240 which flew on December 29, 1950. This engine was later developed into the T56, which was used to power two military Convair variants designated YC-131C; one of these aircraft has been widely used in development of the Electra powerplant installation. Earlier this year Allison embarked upon a campaign to sell the idea of Convair conversions with two of their 501D-13 turboprops, the powerplant installation being the same as that used in the Electra. Estimated data for this variant are shown here.

Napier, meanwhile, are rather more advanced than Allison with the proposal to install Eland turboprops. A Convair 340 with these engines first flew on February 4, 1956, and is now in the U.S.A. completing C.A.A. certification trials. A Convair 440 is in process of conversion by PacAero and two more are being converted by Canadair, all for demonstration, crew training and familiarization purposes. In December, PacAero at Santa Monica will begin the conversion of three Convairs for REAL Aerovias of Brazil, this being the first airline to adopt the conversion technique operationally.

The converted Convair 440 with Elands has characteristics substantially the same as those for the Canadair 540, described on page 31. The photograph above shows a Convair 340 with Elands.

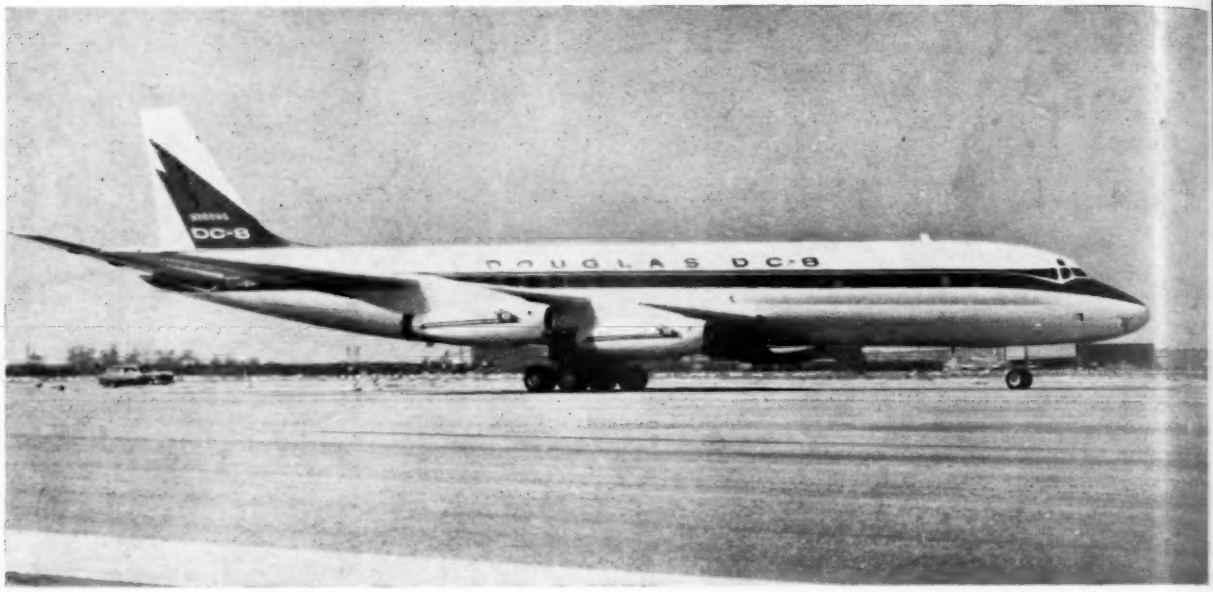
ALLISON-440

Powerplants
Two Allison 501–D13.
Take-off power each (I.S.A., s.l.): 3,750 e.h.p. at 13,820 r.p.m.
Aeroproducts FN–606 four-blade reversing propellers, 13 ft. 6 in. diameter.

Weights and Loadings
Basic operational: 32,100 lb.
Total fuel: 11,590 lb.
Mfrs. max. payload: 12,840 lb.
Max. take-off: 53,200 lb.
Max. landing: 50,670 lb.
Max. zero fuel: 45,000 lb.
Wing loading (max. t-o. wt.): 57.8 lb./sq. ft.
Wing loading (max. landing wt.): 55.1 lb./sq. ft.
Power loading (max. t-o. wt.): 7.09 lb./e.h.p.

Design Criteria
Design limits: Vc = 285 k. Vne = 318 k. Vd = 353 k.

Performance
Recommended cont. cruising speed (I.S.A.): 300 knots (at 20,000 ft. and 45,000 lb.); consumption: 258 Imp. gal./hr.; power (per engine): 2,140 e.h.p.
Approach speed (at max. landing wt.): 100 knots.
Balanced field lengths (at max. t-o. wt.): At I.S.A. at sea level: 4,600 ft.
At I.S.A.+15°C. at sea level: 6,050 ft.
At I.S.A. at 5,000 ft.: 6,375 ft.
Landing distance from 50 ft. (unfactored, max. landing wt.): 4,400 ft.
Range (take-off to landing), still air, no reserves, I.S.A., max. fuel (1,440 Imp. gal.): 1,624 naut. mi. with 9,600 lb. payload at 300 knots (mean) at 20,000 ft. (mean).
Range (take-off to landing) still air, no reserves, I.S.A., with max payload: 1,150 naut. mi.



The Douglas DC-8

ALL the resources of the Douglas Aircraft company have been put behind the DC-8, which has now gone into production virtually under a crash programme. This was necessary if Douglas were to compete effectively with the Boeing 707—which has been flying in prototype form since 1954 and is supported by large military orders for the KC-135. By investing, to date, something like $250 million of their own money and by embarking on probably the biggest and most ambitious programme ever on a brand-new, unproven design, Douglas expect to keep Boeing's lead in actual commercial service down to about one year.

The DC-8 made its first flight from Long Beach on May 30, remaining airborne for 2 hr. 7 min. before landing at Edwards Air Force Base in the Mojave desert. From there it has since been engaged in preliminary flight investigations prior to starting the actual C.A.A. certification programme. This programme is designed to obtain a type certificate for the basic DC-8 configuration with JT-3C engines by October, 1959, and is not expected to be delayed, although the first flight itself had originally been planned for April 20.

The certification programme will use four aircraft with JT-3C engines, three with JT-4As (certification target November, 1959), and two with Conways (certification target February, 1960). While these nine aircraft are collectively engaged in C.A.A. trials totalling over 1,500 hours, about 25 more DC-8s will come off the line for use by the customer airlines on route proving and crew familiarization. When the certificate is obtained, therefore, there will be over 30 aircraft ready for immediate airline service.

The first DC-8 is at present a Douglas-owned aircraft to United Air Lines' specification. The second, which is being used for structural testing, will in due course be completed as the first with JT-4As and is a P.A.A. aircraft; thereafter, the initial production line contains an assortment of U.A.L. and P.A.A. aircraft for use in the certification programme. The first with Conways (for T.C.A.) is No. 9, now in the structural assembly area at Long Beach; and 10 of the 17 customers for the DC-8 are represented in the first 60 aircraft to come off the line.

In addition to the structural test programme, Douglas have a water tank pressure test programme under way and had completed 120,000 cycles up to the end of May. This has already proved the structural integrity of the fuselage and is now being continued indefinitely to prove the fail-safe characteristics of the DC-8 design. This design has a number of interesting and advanced features, which have previously been described, several of

DOUGLAS DC-8

Customer	Quantity	Option	Announced value	Date of contract announcement	Delivery begins	Remarks
Pan American	25*	—	$160m.	Oct. 13, 1955	Dec., 1959	JT-4A International
United	22	—	$175m.	Oct. 25, 1955	May, 1959	JT-3C Domestic
United	18	—		Oct. 25, 1955	May, 1959	JT-4A Domestic
National	6	—	$37m.	Nov. 7, 1955	Aug., 1959	JT-4A Domestic
K.L.M.	8	—	$50m.	Nov. 16, 1955	Mar., 1960	JT-4A International
Eastern	20	—	$105m.	Dec. 7, 1955	Mar., 1960	JT-4A Domestic
S.A.S.	7	—	—	Dec. 21, 1955	Mar., 1960	JT-4A International
Japan Air Lines	4	—	$27.5m.	Dec., 1955	Sept., 1960	JT-4A International
Swissair	3	—	$18m.	Jan. 31, 1956	June, 1960	JT-4A International
Delta	6	—	$31.1m.	Feb., 1956	June, 1959	JT-3C Domestic
Delta	2	—	$11m.	May, 1956	—	JT-4A Domestic
T.C.A.	6	—	$28m.	May 9, 1956	Mar., 1960	Conway International
U.A.T.	2	—	$11m.	Nov. 19, 1956	June, 1960	JT-4A International
T.A.I.	2	—	$11m.	Dec. 19, 1956	June, 1960	JT-4A International
Olympic Airways	2	—	$17m.	July 15, 1957	1960	JT-4A International
Trans Caribbean	1	—	—	Jan., 1958	Dec., 1960	JT-3C Domestic
Alitalia	4	—	$27m.	Mar. 6, 1958	1960	Conway International
Iberia	2	1	—	—	—	Unconfirmed by Douglas

* Includes four each for PAA affiliates Pan American-Grace and Panair do Brasil.

DC-8

Dimensions
- Span: 139 ft. 8 in.
- Overall length: 150 ft. 6 in.
- Overall height: 42 ft. 4 in.
- Gross wing area: 2,758 sq. ft.
- Sweepback: 30° on 25% M.A.C.
- Internal cabin dimensions:
  - Length (ex. flight deck): 103 ft. 0 in.
  - Max. width: 140 in.
  - Max. height: 80 in.
  - Max. usable floor area (ex. flight deck): 1,100 sq. ft.
  - Max. usable volume (ex. flight deck): 7,345 cu. ft.

Accommodation
- Normal first-class: 116 (5 abreast).
- Normal tourist: 140 (6 abreast).
- Max. coach: 176 (6 abreast).
- Volume of freight and baggage holds: 1,390 cu. ft. in two holds.

Structure: Three-spar wing, assembled in one piece. Integral fuel tanks between front and rear spars. Monocoque elliptical-section fuselage.

Undercarriage: Four-wheel main bogies, inwards-retracting with castoring rear trucks for taxi-ing. Twin-wheel steerable nose wheel. Hydraulic brakes.

Flaps: Double-slotted, 30%-chord flaps in four portions.

Air Brakes: Four upper-wing spoilers, linked with nose-wheel, to destroy lift in landing; thrust-brake under development.

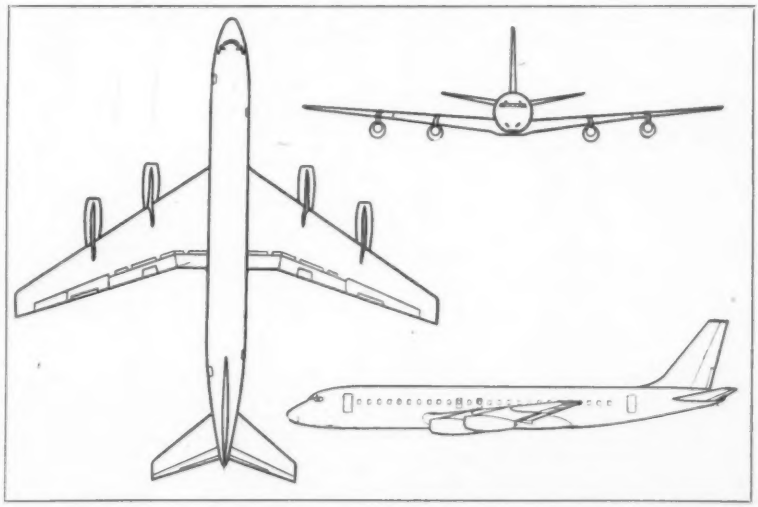
Flying Controls: Interconnected two-piece ailerons each side; outer portions operate through pre-loaded torque link from inners at low speeds only; inners hydraulically boosted. Hydraulically boosted rudder. Manual elevator with aerodynamic tabs, and hydraulic v.i. tailplane.

Systems: Duplicated 3,000 p.s.i. hydraulic systems for power controls, flaps, u/c, brakes and nose-wheel steering. Four three-phase engine-driven generators for 120/208V, 400 cycle AC and four rectifiers for 28V. DC. De-icing of wings, tail unit and engine intakes by engine-bleed air; Nesa glass windscreen and air-blast rain removal. Cabin pressurization at 8.77 p.s.i.; by four turbocompressors driven by engine compressed air. Four-point pressure refuelling at 1,400 g.p.m.

Commercial Aircraft . . . .

	Domestic	Domestic	International	International	International	International
Powerplant:						
Type and number	4 P. & W. JT-3C-6	4 P. & W. JT-4A-3	4 P. & W. JT-4A-3	4 R.-R. Conway 507	4 P. & W. JT-4A-9	4 R.-R. Conway R.Co.12
Rated take-off power (I.S.A. at s.l.), lb. s.t.	13,000 (wet)	17,000* (dry)	17,000* (dry)	16,500 (dry)	—	—
Weights and loadings:						
Basic operational, lb.	123,300	125,663	130,778	128,752†	132,310†	130,164†
Total fuel, lb.	114,400	114,400	140,500	140,500	151,500	151,500
Manufacturers' maximum payload, lb.	39,100	39,337	40,222	41,098	44,190§	44,436§
Maximum take-off, lb.	265,000	265,000	287,500	287,500	310,000	310,000
Maximum landing, lb.	189,000	189,000	194,000	194,000	199,500	199,500
Maximum zero fuel, lb.	162,400	165,000	171,000	169,850	176,500	174,600
Wing loading, maximum t.o. wt., lb./sq. ft.	96.0	96.0	104.2	104.2	112.2	112.2
Wing loading, maximum landing wt., lb./sq. ft.	68.5	68.5	70.4	70.4	72.4	72.4
Power loading, maximum t.o. wt., lb./lb.s.t.	5.1	3.89*	4.22*	4.35	—	—
Design limit speeds:						
Mc/Vc (knots E.A.S.)	.88 (340–360)	.88 (340–360)	.88 (340–356)	.88 (340–356)	.88 (340–356)	.88 (340–356)
Mne/Vne (knots E.A.S.)	.88 (380)	.88 (380)	.88 (380)	.88 (380)	.88 (380)	.88 (380)
Md/Vd (knots E.A.S.)	.95 (406–416)	.95 (406–416)	.95 (406–416)	.95 (406–416)	.95 (406–416)	.95 (406–416)
Performance:						
Recommended cont. cruise speed, knots	487	511	511	513	511	513
At alt. (ft.) at weight (lb.)	30,000/220,000	30,000/220,000	30,000/220,000	30,000/220,000	30,000/220,000	30,000/220,000
With consumption, Imp. gal./hr. at maximum cruise power	1,740	—	—	—	—	—
Approach speed (1.3 Vso), knots	131	131	132	132	134	134
Balanced field length, at maximum t.o. wt., I.S.A. at s.l., ft.	9,170 (246,700 lb.)	7,320	8,430	8,260	9,220	9,050
Landing distance from 50 ft. (unfactored) at maximum land. wt., ft.	4,010	3,980	4,110	4,110	4,260	4,260
Range with maximum fuel, t.o. to landing, no reserves, still air, I.S.A. naut. mi.	4,920	4,950	5,860	5,860	5,925	5,925
With payload, lb./Imp. gal. fuel	21,300/14,680	24,937/14,680	16,222/18,000	18,248/18,000	26,190/19,420	28,336/19,420
At mean speed (knots) at alt. (ft.)	461/37,500	478/38,000	478/37,000	478/37,000	479/36,000	479/36,000
Range with maximum payload, naut. mi.	4,200	4,195	4,610	4,665	5,010	5,105

* Approximate figures. † Mixed class interior, 132 passengers. § Difference between basic operational gross wt. and maximum zero fuel wt.



these at an early stage in production.

All production versions of the DC-8 have the same dimensions and external characteristics, but at least six major versions are now on offer to the airlines, apart from variants with different interior layouts and cockpit arrangements for specific customers.

The basic DC-8 Jetliner is powered by JT-3C engines and has a weight of 265,000 lb. This is intended for domestic operation in the U.S.A. and is alternatively available with JT-4 engines if better field-length performance is required. For international operations, the basic aircraft has JT-4A engines and a weight of 287,500 lb., with additional tankage. This is alternatively available with Rolls-Royce Conway engines. With either JT-4As or Conways, Douglas now offer a long-range international version with a gross weight of 310,000 lb. and tankage increased by 1,400 Imp. gallons; this version is based on assumed engine power increase to 19,000-20,000 lb.s.t. by 1961.

them being exclusive to the DC-8. These include the high-speed Douglas wing section; the angled pylon fairings over the top of the wing; the castoring rear trucks on the main undercarriage bogies which are freed when the nose-wheel steers beyond 45 degrees; "blow-away" jets on the engines to prevent the ingestion of debris; the use of spoilers to reduce the landing run; and the Douglas-developed combination suppressors and thrust brakes.

The last-mentioned include a suppressor design derived from the Rolls-Royce Greatrex type and known to Douglas as a "daisy," together with a thrust brake contained in a central portion of the pod which slides aft for use. When in the operating position, this section of the pod produces an annular intake around the "daisy" which, Douglas claim, helps to recover the power loss due to the suppressor. The brake or reverser is of the conventional clam-shell type, and is being developed with a view to operation in the air as well as at landing. Speed brakes are carried on the first few aircraft, on each side of the fuselage behind the wing fillets, but it is intended to dispense with

Commercial Aircraft . . . .

The Fokker/Fairchild F-27 Friendship

PRODUCTION models of the F-27 reached the flight-test stage in the spring of 1958 both at Amsterdam, where the Fokker production line is established, and at Hagerstown, Md., where Fairchild are building the F-27. Prior to this, Fokker had built four prototypes, of which two were used in extensive structural and fatigue tests.

The design was started early in 1951, as a DC-3 replacement, following an extensive market survey by Fokker, and the first prototype flew on November 24, 1955. The second Fokker flying prototype had a 36-in. fuselage extension, increasing the basic seating from 32 to 36, and this longer fuselage is used on all production aircraft.

Fairchild interest in the F-27 goes back many years, and was part of a continuing association between the two companies. The decision to go ahead with production in the U.S.A. was made in 1956, with engineering work starting in June of that year. From then up to the first flight something under 600,000 engineering hours were expended by Fairchild and $25 million was invested in the project. The Fokker drawings had to be completely converted to U.S. standards and dimensions and, at the same time, much U.S. equipment was substituted and some new features were introduced.

Briefly, the Fairchild F-27 differs from the Fokker basic model in having a Stratos-designed air-conditioning system; integral stairs in the main passenger door; fuel capacity increased from 952 to 1,320 U.S. gallons, plus provision for another 340 U.S. gallons in a centre-section bag tank in the executive version; pressure refuelling; lengthened nose for weather radar; and standard accommodation for 40 passengers.

Fairchild actually have three basic models in the works: the airline F-27, sub-divided into various interior arrangements ranging from 36 to 44 seats; the executive with a standard 16-seat interior; and a cargo-convertible model with large forward cargo door and stronger floor. Prospects of selling the latter to the U.S.A.F. in large numbers seem particularly good; in any case, Fairchild foresee no difficulty in reaching their break-even point of 200 and have estimated a sales potential of not less than 1,000 during the next 10 years.

The first Fairchild F-27 flew on April 12, 1958, followed on May 23 by the second. Both these will be kept as

FAIRCHILD F-27

Dimensions
Span: 95 ft. 2 in.
Overall length: 77 ft. 2 in.
Overall height: 27 ft. 6 in.
Gross wing area: 754 sq. ft.
Sweepback: Nil.
Internal cabin dimensions:
Length (ex. flight deck): 47 ft. 6 in.
Max. width: 106 in.
Max. height: 80 in.
Max. usable floor area (ex. flight deck): 250 sq. ft.
Max. usable volume (ex. flight deck): 1,620 cu. ft.

Accommodation
Normal first-class: 40 (4 abreast).
Normal tourist: 44 (4 abreast).
Volume of freight and baggage holds: None.

Structure: Two-spar wing comprising centre section, outer panels and tips, with Redux bonding. Integral fuel tanks in outer panels. Semi-monocoque oval-section fuselage. Principal materials, 75S–T6 and 24S–T4 alloy.

Undercarriage: Twin wheel main units, retracting rearwards. Twin-wheel steerable nose-wheel, forwards-retracting. Pneumatic brakes.

Flaps: Single-slotted in one piece each side, electrically-actuated.

Air Brakes: None.

Flying Controls: Manual, aerodynamically-balanced ailerons with trim, spring and servo tabs; manual, aerodynamically-balanced elevator and rudder, the latter with geared and trim tabs.

Systems: Two independent 3,300 p.s.i. pneumatic systems powered by engine-driven compressors for u/c, nose-wheel steering and wheel brakes. Primary 24–28V. DC electric system from two engine-mounted generators and secondary three-phase 115V. 400-cycle AC circuit from two inverters. Cabin pressurization 4.16 p.s.i. by two engine-driven compressors. De-icing of wing and tail unit by rubber boots; electrical de-icing of intakes, propellers, spinners, and windshield.

FAIRCHILD F-27

Powerplants
Two Rolls-Royce Dart 511 (R.Da.6).
Take-off power each (I.S.A., s.l.): 1,720 e.h.p. at 14,500 r.p.m.
Rotol c.s., f.f. four-bladed propeller, 12 ft. diameter.

Weights and Loadings
Basic operational: 23,404 lb.
Total fuel: 8,844 lb.
Mfrs. max. payload: 8,996 lb.
Max. take-off: 35,700 lb.
Max. landing: 34,000 lb.
Max. zero fuel: 32,400 lb.
Wing loading (max. t.–o.wt.): 47.3 lb./sq. ft.
Wing loading (max. landing wt.): 45.1 lb./sq. ft.
Power loading (max. t.–o.wt.): 11.1 lb./e.h.p.

Design Criteria
Design limits: Vc=227 k. Vne=259 k. Vd=288 k.

Performance
Recommended cont. cruising speed (I.S.A.): 260 knots (at 20,000 ft. and 35,000 lb.); consumption: 185 Imp. gal./hr.; power (per engine): max. cruise.
Approach speed (at max. landing wt.): 90 knots.
Balanced field lengths (at max. t.-o.wt.):
At I.S.A. at sea level: 3,650 ft.
At I.S.A. 15°C. at sea level: 3,800 ft.
At I.S.A. at 5,000 ft.: 4,550 ft.
Landing distance from 50 ft. (unfactored, max. landing wt.): 3,700 ft.
Range (take-off to landing), still air, no reserves, I.S.A., max. fuel (1,100 Imp. gal.): 1,570 naut. mi. with 3,452 lb. payload at 200 knots (mean) at 20,000 ft. (mean).
Range (take-off to landing) still air, no reserves, I.S.A., with max. payload: 590 naut. mi.

FOKKER F-27

Customer	Quantity	Option	Date of contract announcement	Delivery	Remarks
K.L.M.	2	—	Jan., 1955	1959–60	—
Aer Lingus	7	—	Mar, 29, 1956	1958–59	Service this year.
T.A.A.	12	—	April, 1956	1958–59	—
Braathens SAFE	3	2	1956	1959	—
T.A.E.	3	3	June 20, 1957	1959	Spanish operator.
Aviaco	6	—	Feb., 1958	May–Nov. 1959	Spanish operator.
Netherlands Govt.	1	—	Jan., 1956	1959	For Royal Flight.
R.I.V. (Turin)	1	—	Aug., 1956	1959	For Dr. G. Agnelli, Fiat v.-p.
Australian D.C.A.	2	—	Jan. 14, 1957	July, 1959	—
Iranian Oil	2	2	—	1960	Executive.
Mr. Horten	1	1	—	1960	Executive.
Sabena	12	—	Feb., 1958	—	Reported intention to order.
Philippine Airlines	2	—	June, 1957	—	Not confirmed by Fokker.

FAIRCHILD F-27

West Coast Airlines	6	—	Dec. 2, 1955	June, 1960	Dart 511.
Mackey Airlines	2	—	Jan. 5, 1956	Nov., 1958	—
Bonanza Air Lines	6	6	May 11, 1956	Aug., 1958	—
Piedmont Airlines	10	5	Jan. 24, 1956	July, 1958	Dart 511.
Quebecair	2	—	Sept. 25, 1956	Sept., 1958	—
Aerovias Ecuatorianas	1	1	Dec. 14, 1956	Feb., 1959	—
Northern Consolidated	3	—	Dec. 18, 1956	Jan., 1959	Dart 528.
Pacific Airlines	5	—	March 1, 1957	Dec., 1958	—
Aerovias Venezolanas	5	3	July 22, 1957	Oct., 1958	—
Wien Alaska Airlines	3	—	June 19, 1957	May, 1958	Dart 528
Wheeler Airlines	2	—	May 9, 1957	May, 1958	—
L.A.V.	6	6	Nov. 27, 1957	—	—
Unannounced Airlines (3)	8	3	—	—	—
Corporations*	13	1	—	—	—

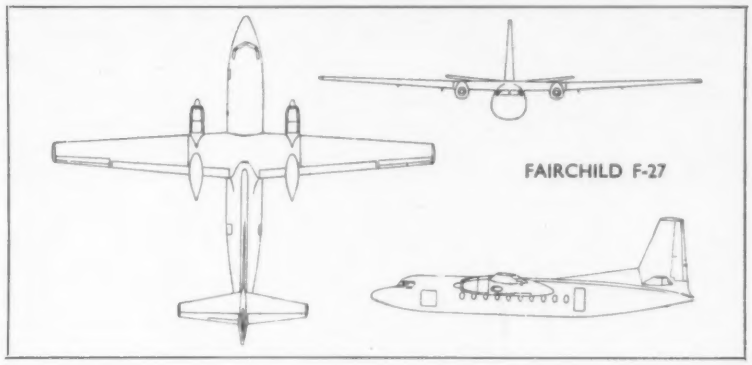
* Corporate customers include: Continental Can; General Tire and Rubber; Butler Aviation; Champion Spark Plug; Bank of Mexico; Westinghouse Electric Corp.; Ideal Cement Co. and Kimberly-Clark Co.

demonstrators; the third aircraft was delivered to West Coast Airlines on June 22. The larger Dart 528 (R.Da.7) engines have been specified by several purchasers and the first F-27 is now being fitted with these engines in order to get C.A.A. clearance.

The effect of installing 1,960-e.h.p. Dart 528s is to improve take-off performance, especially in hot or high-altitude conditions, and to boost the guaranteed cruising speed to 300 m.p.h. There is, however, a slight payload penalty as the engines are a little heavier.

Fairchild production will initially be at a rate of five a month, increasing up to 10 a month as necessary. Fokker flew their first production F-27 on March 23, 1958, and this will go to Aer Lingus later this year. Fokker production will increase to four a month in 1959.

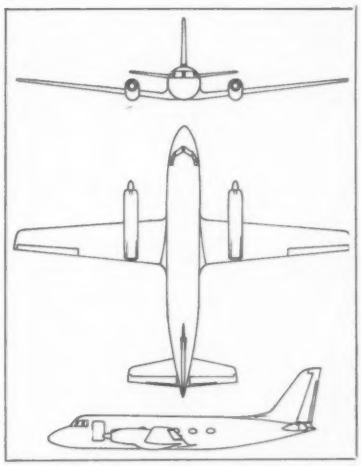
Commercial Aircraft . . . .



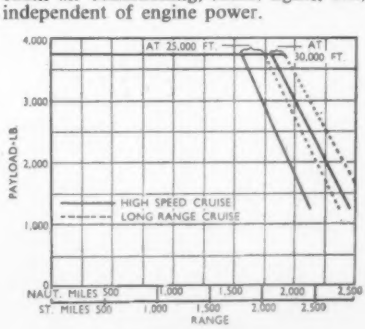
The Grumman Gulfstream

GRUMMAN AIRCRAFT ENGINEERING CORP. are re-entering the commercial aircraft market, after a pause of nearly 10 years, with the Gulfstream executive transport. The corporate aircraft market was chosen by Grumman as one which most needed attention, there being no new equipment in production specifically for this type of operation. The field was carefully surveyed to obtain the views of likely users of such equipment, and the specifications of the Gulfstream were established early in 1957. Engineering work began in May, 1957, and the first Gulfstream will fly within the next few weeks.

The basic parameters chosen were a 12-seat executive interior, two turboprop engines, full payload range of 1,500 naut. miles and cruising speed of 310 knots. Two Rolls-Royce Darts (in the R.Da.7/2 variety) were selected for their proven reliability and it is worth noting that the Gulfstream characteristics are very similar to those of the abandoned Aviation Traders Accountant. Maximum attention has been given to fail-safe design, a typical example being the wing skins in four integrally-stiffened spanwise planks, any one of which can fail without catastrophic results. The wing box beam contains the integral fuel tank and the whole wing is assembled into one piece before mating with the fuselage.



Characteristic of the business flying rôle are features like the built-in airsteps and self-contained equipment for ground handling, including engine starting and cabin air conditioning, radio, lights, etc., independent of engine power.



GULFSTREAM

Powerplants
Two Rolls-Royce Dart 529 (R.Da.7/2).
Take-off power each (I.S.A., s.l.): 2,100 e.h.p. at 15,000 r.p.m.
Water/methanol system provided.
Rotol four-blade propellers, 11 ft. 6 in. diameter.

Weights and Loadings
Basic operational: 19,680 lb.
Total fuel: 8,800 lb.
Mfrs. max. payload: 3,780 lb.
Max. take-off: 31,000 lb.
Max. landing: 30,000 lb.
Max. zero fuel: 23,259 lb.
Wing loading (max. t-o. wt.): 50.4 lb./sq. ft.
Wing loading (max. landing wt.): 48.8 lb./sq. ft.
Power loading (max. t-o. wt.): 7.54lb./e.h.p.

Design Criteria
Mc/Vc=.54 (290k. i.A.S.)
Mne/Vne=.60 (310k. I.A.S.)
Md/Vd=.675 (341k. I.A.S.)

Performance
Recommended cont. cruising speed (I.S.A.): 304 knots (at 25,000 ft. and 2,780 lb.); consumption: 194 Imp. gal./hr..
Approach speed (at max. landing wt.): 100 knots.
Balanced field lengths (at max. t-o. wt.): At I.S.A. at sea level: 3,450 ft.
At I.S.A.+20°C. at sea level: 3,520 ft.
At I.S.A. at 5,000 ft.: 4,760 ft.
Landing distance from 50 ft. (unfactored, max. landing wt.): 2,280 ft.
Range (take-off to landing), still air, no reserves, I.S.A., max. fuel (1,232 Imp. gal.): 2,144 naut. mi. with 1,320 lb. payload at 304 knots (mean) at 25,000 ft. (mean).
Range (take-off to landing), still air, no reserves, I.S.A., with max. payload: 1,565 naut. mi.

Dimensions
Span: 78 ft. 6 in.
Overall length: 63 ft. 9 in.
Overall height: 22 ft. 9 in.
Gross wing area: 615 sq. ft.
Sweepback: Nil.
Internal cabin dimensions:
Length (ex. flight deck): 33 ft. 0 in.
Max. width: 88 in.
Max. height: 73 in.
Max. usable floor area (ex. flight deck): 177 sq. ft.
Max. usable volume (ex. flight deck): 1,040 cu. ft.

Accommodation
Normal executive: 10–12 (2 abreast).
Normal tourist: 18 (3 abreast).
Volume of freight and baggage hold: 100 cu. ft.

Structure: Two-spar one-piece wing with integrally-stiffened skins. Integral fuel tanks from ailerons to fuselage. Circular-section monocoque fuselage. Primary materials, 14ST and 24ST alloy in fuselage, 75ST in wing.

Undercarriage: Twin-wheel main units, retracting forwards. Twin-wheel steerable nose-wheel retracting backwards. Hydraulic brakes.

Flaps: Single-slotted Fowler-type, 30% chord, in one piece each side.

Air Brakes: Undercarriage up to Vne.

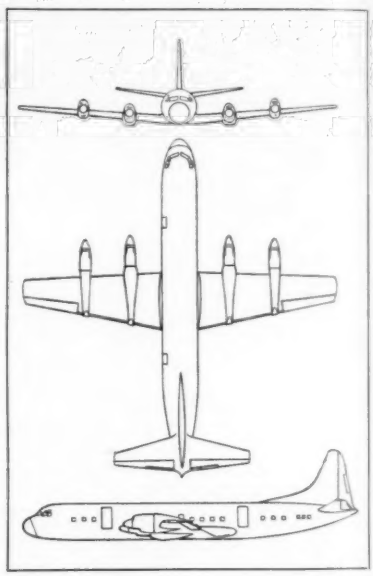
Flying Controls: Fully manual ailerons, elevator and rudder with aerodynamic balance and mechanical spring and trim tabs.

Systems: 1,500 p.s.i. hydraulic system from two engine-driven pumps for flaps, u/c, brakes, integral stairs, nose-wheel steering, propeller brakes and windshield wipers. Primary DC electrics from two engine-mounted generators, and secondary AC system through two inverters. Cabin pressurization 6.5 p.s.i. by one engine-driven compressor. De-icing of wings and tail unit by compressor-bled air. Nesa-glass windscreen.

In accordance with Grumman custom, the Gulfstream has been tooled for production from the start, in the old Plant No. 1 at Bethpage, Long Island. An initial batch of five has been put in hand regardless of customers, and two of these will be used in the certification programme, with a target of May, 1959. The second airframe produced is being used for a tank test. The rate of production will be 3-5 a month initially and about 20 customers have already placed token deposits, their orders being subject to confirmation after flight trials.

Grumman will produce a bare airframe, at $700,000 without electronics, furnishing and special equipment. Furnishing, to customer requirements, will be handled by Gulfstream distributors, three in the U.S.A. and one in Canada. As a feeder-liner, the Gulfstream could seat 19 in a three-abreast layout, and up to 25 if four-abreast seating was used, as in some DC-3s now in service.

The Lockheed Electra



Commercial Aircraft . . . .

SINCE the Electra made its first flight on December 6, 1957, Lockheed have been making remarkable progress and have more than maintained the six-weeks improvement on schedule which the first flight itself represented. In common with the other U.S. manufacturers of turbine-engined transports, Lockheed tooled for production from the outset and while four Lockheed financed prototypes were engaged in certification trials, deliveries of airline Electras from this line have been mounting.

The actual sequence of flights since the first has been: No. 2, on February 13; No. 3, static test at present, to fly later; No. 4, April 10; No. 5 (the first for Eastern), May 19; and No. 6 (for General Motors), mid-June. Nos. 7 to 15 are all for Eastern Air Lines, followed by the first for American Airlines, now in the final assembly area, and then a mixture of Eastern and American aircraft to No. 38. Up to the end of May, the first four Electras had amassed over 420 hours in the air and Lockheed had advanced the C.A.A. certification target date from September 30 to August 22, 1958. First deliveries will be to Eastern, who expect to have the Electra in service by the end of September.

First customer for the international

Powerplants

Four Allison 501–D13.
Take-off power each (I.S.A., s.l.): 3,750 e.h.p. at 13,820 r.p.m.
Water injection system installed.
Aeroproducts A6441FN–606 four-blade reversing propellers, 13 ft. 6 in. diameter.

Weights and Loadings

Basic operational: 58,900 lb.
Total fuel: 35,912 lb.
Mfrs. max. payload: 27,000 lb.
Max. take-off: 113,000 lb.
Max. landing: 95,650 lb.
Max. zero fuel: 86,000 lb.
Wing loading (max. t-o. wt.): 86.9 lb./sq. ft.
Wing loading (max. landing wt.): 73.6 lb./sq. ft.
Power loading (max. t-o. wt.): 7.5 lb./e.h.p.

Design Criteria

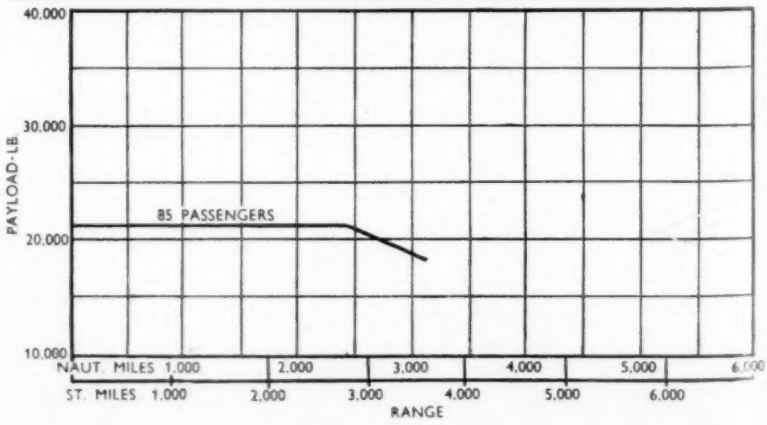
Design limits: Mc/Vc=.615 (324 k.) Vne=364 k. Md/Vd=.711 (405 k.)

Performance

Recommended cont. cruising speed (I.S.A.): 352 knots (at 22,000 ft. and 85,500 lb.); consumption: 501 Imp. gal./hr.; power (per engine): 90% MRT.
Approach speed (at max. landing wt.): 121 knots.
Balanced field lengths (at max. t-o. wt.): At I.S.A. at sea level: 5,500 ft.
At I.S.A.+20°C. at sea level: 6,700 ft.
At I.S.A. at 5,000 ft.: 7,850 ft.
Landing distance from 50 ft. (unfactored, max. landing wt.): 3,240 ft.
Range (take-off to landing), still air, no reserves, I.S.A., max. fuel (4,460 Imp. gal.): 3,170 naut. mi. with 21,195 lb. payload at 325 knots (mean) at 2,600 ft. (mean).
Range (take-off to landing), still air, no reserves, I.S.A., with max. payload: 2,900 naut. mi.

LOCKHEED ELECTRA ORDERS

Customer	Quantity	Announced value	Date of contract announcement	Delivery begins
American Airlines	35	$65m.	June 8, 1955	Jan., 1959
Eastern Air Lines	40	$100m.	Sept. 27, 1955	Oct., 1958
Braniff	9	$22m.	Dec. 14, 1955	May, 1959
National	23	$52m.	Jan. 3, 1956	April, 1959
K.L.M.	12	$30m.	Mar. 8, 1956	Sept., 1959
Western	9	$19.5m.	April 19, 1956	1959–60
General Motors	1	—	Jan. 1957	1958
Ansett	2	—	Sept. 25, 1957	Early 1959
Garuda	3	—	1957	—
Cathay Pacific	2	—	Sept. 12, 1957	Mid-1959
Pacific Southwest Airlines	3	$8m.	Sept. 19, 1957	End 1959
Aeronaves de Mexico	3	$12m.	Nov. 19, 1957	First qtr. 1960
Qantas	4	—	May 23, 1958	Last qtr. 1959
TEAL	3	—	May 23, 1958	Last qtr. 1959
T.A.A.	2	—	May 23, 1958	First qtr. 1959



version of the Electra, which has a few differences in the way of internal layout, flight deck provisions and equipment, was K.L.M., but the first overseas delivery is now expected to be made to Ansett-A.N.A. as a result of some juggling of the production line positions of the U.S. domestic aircraft.

Production of the Electra is handled at Lockheed's Burbank factory, with the major assemblies of wings and fuselages in Building 5 and complete assembly in Building 6. The latter was erected for construction of the two Lockheed Constitution transports for the Navy and has since been used for Constellation assembly. Production of the Constellation is expected to cease before the end of 1958, with more than 1,000 built for military and civil use.

Lockheed will certify the Electra at a gross weight of 113,000 lb., in both domestic and international versions, but foresee an increase of 3,000 lb. in the fairly near future. In the face of growing competition from turbojet transports, the Lockheed sales line is to emphasize the operating economy of the Electra coupled with the convenience of operation, ability to use small airports close to city centres and the frequency of service possible with smaller fleet units.

Publicly, at least, the company still forecasts commercial sales totalling at least 400 Electras—the approximate break-even figure to cover the very high tooling costs. Whether or not this total is reached, however, Lockheed now have a U.S. Navy contract to develop an anti-submarine patrol version of the Electra, the prototype of which is expected to fly early in 1959. As this aeroplane is intended to replace the P2V Neptune in production and service, sales of no fewer than 200 units are confidently anticipated, and clearly enough these will serve to underwrite production costs of the commercial variant.

The Electra design follows fail-safe and safe-life philosophies, with optimization of structure, regardless of tooling expense. The result is an airframe of high structural integrity, if not particularly elegant appearance. When peak production rate of 10½ a month is reached early next year, the production span, from cutting metal to roll-out, will be 60 days on each aircraft according to the makers.

Use of the Allison 501D-13 turboprops was in a sense dictated by lack of optional engine types. These engines are performing satisfactorily after a major development and proving programme designed to build up hours. Lockheed are now anxious to improve the efficiency (i.e., lower the consumption) of these engines, but do not at present see any necessity to seek extra power. Engines such as the Allison 550 and Rolls-Royce Tyne have been studied, but present thinking is that these more powerful engines would not make the Electra more saleable.

Dimensions
- Span: 99 ft. 0 in.
- Overall length: 104 ft. 6½ in.
- Overall height: 32 ft. 11¼ in.
- Gross wing area: 1,300 sq. ft.
- Sweepback: Nil.
- Internal cabin dimensions:
  - Length (ex flight deck): 76 ft. 5 in
  - Max. width: 128 in.
  - Max. height: 100 in.
  - Max. usable floor area (ex flight deck): 704 sq. ft.
  - Max. usable volume (ex flight deck): 4,812 cu. ft.

Accommodation
- Normal first-class: 66* (4 abreast).
- Normal tourist: 85* (5 abreast).
- Max. coach: 99 (6 abreast).
- Volume of freight and baggage holds: 524 cu. ft. in two holds.
- * Plus six in rear lounge.

Structure: Two-spar box-beam wing in two main units joined to 12-ft. 10-in. span centre section integral with fuselage. Extruded, integrally-stiffened wing skins. Four integral fuel tanks. Semi-monocoque circular-section fuselage.

Undercarriage: Twin-wheel main units, backward retracting, and twin-wheel steerable nosewheel. Hydraulic brakes.

Flaps: Fowler-type in one piece each side.

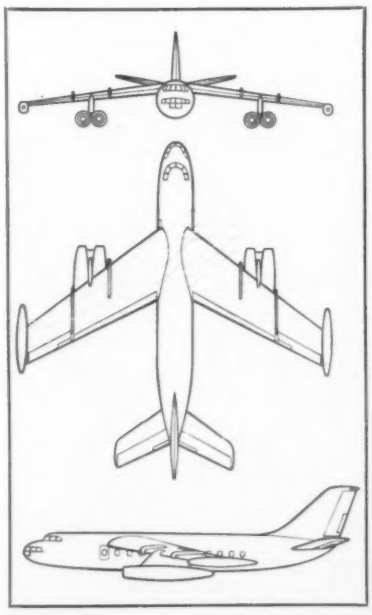
Air Brakes: Three-piece, under fuselage between the flaps.

Flying Controls: Hydraulically-boosted ailerons, elevator and rudder, with manual by-pass and manual trim.

Systems: Two independent 3,000 p.s.i. hydraulic systems for power controls, flaps, u/c, brakes, nose-wheel steering. Four 60-kVA. generators for 208/120V. 400-cycle AC, and two rectifiers for 28V. DC; 24V. battery. Cabin pressurization at 6.5 p.s.i. by two engine-driven compressors. Single-point pressure refuelling at 300 g.p.m.

The Baade BB-152

THE first commercial aircraft designed in East Germany since the end of the War is the Baade BB-152, the prototype of which was recently completed at the Dresden works of the State aircraft industry. Designed by Prof. Brunolf Baade, a former Junkers designer, the BB-152 appears to owe much of its basic design to the EF-150 bomber, which was started at the Junkers works before the end of the War and flew in 1952.



The BB-152 is a 72-seat swept-wing turbojet, unusual for its high wing location and the undercarriage arrangement—each main four-wheel bogie unit retracts into a housing which is carried at the rear base of the engine pod pylon. This arrangement supersedes an earlier layout, carried on the prototype, in which there are tandem paired main wheels in the fuselage (with out-riggers in wing-tip fairings); it was intended that the rear main unit should retract partially at unstick speed in order to allow a natural increase in the angle of attack and thus decrease the take-off run.

Accommodation in the BB-152 is in five-abreast seating and the flight deck has provision for two pilots, radio operator and flight engineer. The cabin is pressurized to a differential of 8 p.s.i. Development and construction of the aircraft have been made possible, according to East German sources, by the help of the Soviet Union in providing material, accessories and wind-tunnel facilities.

The following data for the BB-152 have been given by the makers:—

Span, 88 ft. 6 in.; length 103 ft. 0 in.; gross wing area, 1,485 sq. ft. Basic operational weight (mixed class, 57 passengers), 62,765 lb.; max. payload (tourist layout, 72 passengers), 16,180 lb.; max. payload, freighter, 20,000 lb.; max. fuel, 27,225 lb.; max. take-off weight 102,515 lb.

Cruising speed, 430 knots at 35,000 ft.; landing speed, 108 knots; balanced field length (max. t.-o. weight, 35 ft. screen), I.S.A. at s.l., 5,800 ft.; range with max. fuel, no reserves, 1,350 naut. miles with 11,840 lb. payload (48 passengers); range with max. payload, no reserves 1,080 naut. miles.

Commercial Aircraft . . . .

The Canadair CL-44D

CANADAIR have been making design studies of transport aeroplanes based upon the Britannia for several years. These have finally come to fulfilment in the CL-44D, of which the R.C.A.F. ordered eight a little more than a year ago. The aircraft is therefore being built primarily as a military transport in the first instance, but it is an R.C.A.F. requirement that the CL-44 should be certifiable under CAR 4b, and Canadair are preparing to offer variants of the type for commercial use in 1960.

The CL-44D designation covers three variants: the Canadair Liner passenger transport, the Canadair Freighter cargo transport and the Canadair Freightliner mixed cargo-passenger transport. The R.C.A.F. designation is CC-106.

In order to meet the R.C.A.F. requirement and to take advantage of newer engines available since the Britannia was designed, the CL-44 has been stretched considerably beyond the size and weight of the Britannia 310, with a 12-ft. 4-in. fuselage extension and gross weight put up to 205,000 lb. to make it the heaviest commercial turboprop apart from the Tu-114.

A good deal of time was spent in selecting a powerplant—one of the first CL-44 schemes used the R-3350 piston engines, chosen by the R.C.A.F. for the CL-28 Argus, and the Pratt & Whitney T-34 turboprop was also studied. The choice eventually narrowed to the Tyne and the Orion, however, and it was with Orions that the type was ordered last year (CL-44C). Subsequent to the cancellation of Orion development by the M.o.S., the Tyne Stage II has been substituted and, although considerable redesign has been necessary, including relocation of the wing about 20 in. farther back, Canadair still expect to fly the first CL-44D in December, 1959.

Because of the higher weight, the whole airframe has been strengthened, together with the undercarriage, and large cargo doors, similar to those on the Britannia 253, have been introduced fore and aft. The larger rear door gives a clear opening 78 in. by 120 in. and incorporates a sliding passenger door; the forward door measures 75 in. by 93 in. and also has a sliding passenger

Dimensions
- Span: 142 ft. 4 in.
- Overall length: 136 ft. 9 in.
- Overall height: 38 ft. 11 in.
- Gross wing area: 2,075 sq. ft.
- Sweepback: 7° at 25% M.A.C.
- Internal cabin dimensions:
  - Length (ex. flight deck): 98 ft. 7 in.
  - Max. width: 138 in.
  - Max. height: 80 in.
  - Max. usable floor area (ex. flight deck): 1,080 sq. ft.
  - Max. usable volume (ex. flight deck): 6,400 cu. ft.

Accommodation
- Normal tourist: 124 (6 abreast)
- Max. coach: 171 (6 abreast).
- Volume of freight and baggage holds: 920 cu. ft. in two holds.

Structure: Torsion-box wing structure with spars at 15% and 50% chord, and stiffened stress-carrying upper and lower skins; wing in two main units joined at fuselage centre-line. Integral wing tanks and one bag tank in centre section. Circular section semi-monocoque fuselage. Primary materials, 75ST alloy, with 24ST alloy for fuselage and wing lower-surface skins.

Undercarriage: Four-wheel bogie main units, backwards retracting, and steerable twin-wheel nose-wheel. Hydraulic brakes.

Flaps: Double slotted in one portion on each wing.

Air Brakes: None.

Flying Controls: Fully manual system, with servo operation by tabs on ailerons, elevators and rudder. Spring-loading in aileron and rudder circuits and hydraulic artificial feel system for elevator.

Systems: Main 3,000 p.s.i. hydraulic system for u/c, wheel brakes, nose-wheel steering and cargo-door operation, with emergency compressed-air system for u/c and brakes. Three engine-driven 40 kVA three-phase 400-cycle alternators generating at 115V., plus a variable frequency AC supply from three 60 kVA engine-driven generators and 28V. DC through rectifiers. Cabin pressurization at 8.33 p.s.i. max. by two engine-driven compressors. Wing de-icing by ram air passed over engine tail-pipes; tail unit de-icing by hot air from dual heater system; electric de-icing for intakes, propellers, windscreen and elevator horn balances. Pressure refuelling at 500 g.p.m.

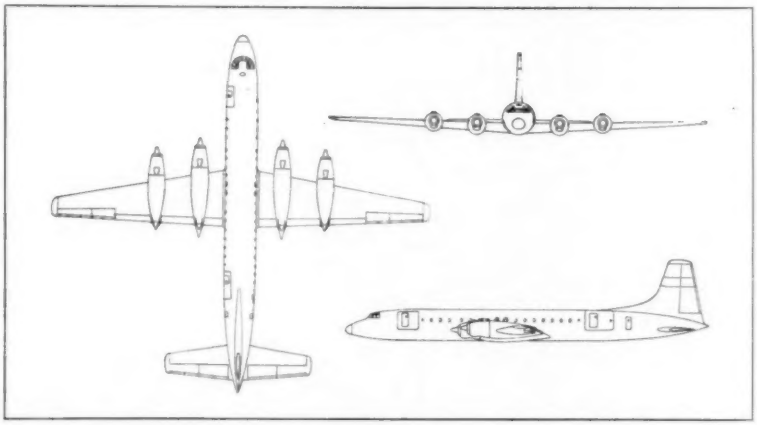
Powerplants
- Four Rolls-Royce Tyne R.Ty.12.
- Take-off power each (I.S.A., s.l.): 5,500 e.h.p. at 15,250 r.p.m.
- De Havilland four-blade reversing propellers, 16 ft. diameter.

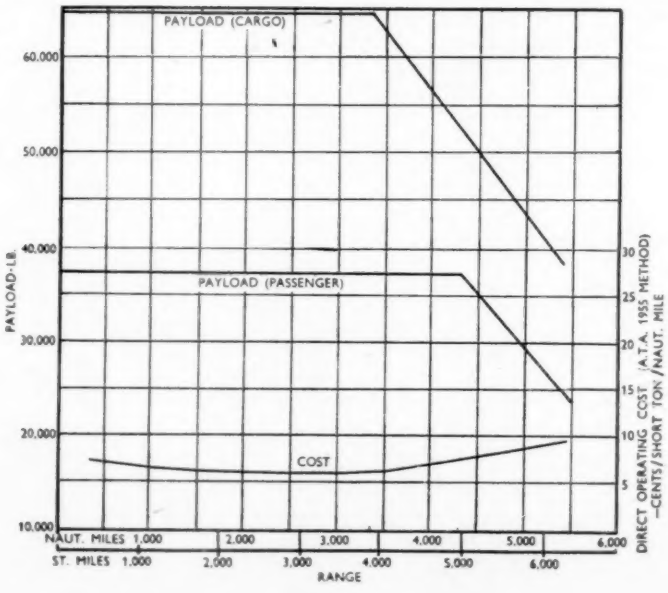
Weights and Loadings
- Basic operational: 98,373 lb.
- Total fuel: 81,200 lb.
- Mfrs. max. payload: 37,400 lb.
- Max. take-off: 205,000 lb.
- Max. landing: 160,000 lb.
- Max. zero fuel: 155,000 lb.
- Wing loading (max. t-o. wt.): 99.0 lb./sq. ft.
- Wing loading (max. landing wt.): 77.2 lb./sq. ft.
- Power loading (max. t-o. wt.): 9.33 lb./e.h.p.

Design Criteria
- Design limits: Mc=.63 (275 k.). Mne=.63 (278 k.). Md=.70 (344 k.).

Performance
- Recommended cont. cruising speed (I.S.A.): 325 knots (at 20,000 ft. and 170,000 lb.); consumption: 700 Imp. gal/hr.; power (per engine): 3,475 e.h.p.
- Approach speed (at max. landing wt.): 122 knots.
- Balanced field lengths (at max. t-o. wt.): At I.S.A. at sea level: 7,250 ft. At I.S.A.+15°C. at sea level: 8,150 ft.* At I.S.A. at 5,000 ft.: 9,000 ft.*
- Landing distance from 50 ft. (unfactored, max. landing wt.): 3,300 ft.
- Range (take-off to landing), still air, no reserves, I.S.A., max. fuel (10,150 Imp. gal.): 5,475 naut. mi. with 25,427 lb. payload at 320 knots (mean) at 30,000 ft. (mean).
- Range (take-off to landing) still air, no reserves, I.S.A., with max. payload 4,750 naut. mi.

* Limited to 197,000 lb. by second segment climb.





entrance. Both cargo doors are hydraulically operated. The floor is designed to handle 300 p.s.i. loads and incorporates six flush tracks forming the bases of a 5,000-lb., 20-in. grid tie-down pattern. An all-passenger version, accommodating up to 171 passengers in international coach-class seating, could have a lighter floor structure and dispense with the cargo doors.

Data for the CL-44D on the previous page refer to the passenger transport. The cargo version, with the same gross weight, has a maximum payload of 69,363 lb., which can be carried 2,980 nautical miles (no reserves). The no-reserves range with maximum fuel works out at 5,475 nautical miles with a 38,163 lb. payload at 320 knots and 30,000 ft. Cruising speed is 323 knots at 20,000 ft. and 180,000 lb.

Apart from the stretched fuselage and the new engines, the CL-44 is closely akin to the Britannia 310 in its structure and systems—much more so, for obvious reasons, than the CL-28 Argus. One feature not found on the Britannia is the gas turbine A.P.U., which will start the engines via 50-60 p.s.i. pneumatic starter on each engine and, when not being used for this purpose, can feed the cabin air-conditioning system with cold or warm air on the ground.

The Canadair 540

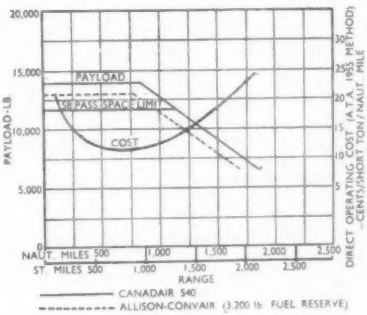
EARLIER this year, Canadair concluded negotiations with the R.C.A.F. for the supply of ten Eland-engined Convair 440s for transport and freight duties. The contract set the seal on Canadair's plans, first considered last year, to put a rejuvenated, turboprop version of the well-established Convair Metropolitan into production in Canada.

Such a project had previously been studied by Convair, who envisaged the use of Napier Eland engines in a version called the Convair 540, but the demand on floor space at San Diego for production of the 880 led to Convair viewing favourably the alternative proposal for Canadair to undertake this work. Both Canadair and Convair are divisions of the U.S. General Dynamics Corporation.

The aircraft as produced in Canada has several designations. Canadair 540 is now the popular name (in place of Cosmopolitan which was favoured at one time). The company designation is CL-66A for the passenger version and CL-66B for the freighter, while the R.C.A.F. designation is CC-109. The freighter has a large cargo door and strengthened floor, as developed by Convair for the C-131.

Production of the Canadair 540 will be in the original Convair jigs, which were moved from San Diego to Montreal during the spring of this year, after Convair had concluded production of the Metropolitan. The aircraft is being re-engineered for the Eland powerplant, this work consisting essentially of "productionizing" Napier's conversion drawings.

Complete powerplants will be obtained from Napier, the present intention being to use Eland 504A engines of N.E1.6 rating. The 504A is similar to the 504 used in Napier's previous conversions, but has provision for air starting from an external source or from a Blackburn Palouste in the port nacelle.



Canadair will benefit from Napier's certification of the Eland-engined Convair 340 and 440, and should be able to offer fully certificated 540s by the end of next year. The first of the R.C.A.F. aircraft, which will be cleared for operation at 57,000 lb. compared with the commercial figure of 52,500 lb., is due to be rolled out next March and fly in May. While the production line is being laid down, two of Convair's last 440s are being converted at Montreal to Eland power. These will be used to gain experience with the engine installation and will subsequently be useful as demonstrators, or for R.C.A.F. familiarization.

Dimensions
Span: 105 ft. 4 in.
Overall length: 81 ft. 6 in.
Overall height: 28 ft. 1.6 in.
Gross wing area: 920 sq. ft.
Sweepback: 4.33° at 25% M.A.C.
Internal cabin dimensions:
Length (ex. flight deck): 54 ft. 10 in.
Max. width: 107 in.
Max. height: 79 in.
Max. usable floor area (ex. flight deck): 396.5 sq. ft.
Max. usable volume (ex. flight deck): 2,515.4 cu. ft.

Accommodation
Normal first-class: 48 (4 abreast).
Max. coach: 58 (4 abreast).
Volume of freight and baggage hold: 778 cu. ft.

Structure: Two-spar wing with integral fuel tanks, assembled in one piece. Circular section semi-monocoque fuselage. Stressed skin covering.

Undercarriage: Twin-wheel main units retracting forwards and twin-wheel steerable nose-wheel retracting forwards.

Flaps: Fowler-type in one piece each side.

Air Brakes: None.

Flying Controls: Fully manual ailerons, elevator and rudder.

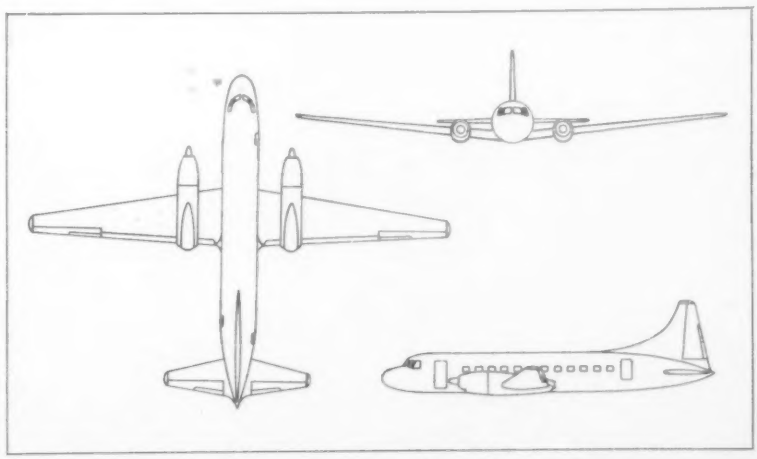
Systems: Cabin pressurization at 4.16 p.s.i. from engine-driven compressors. Hydraulic system for undercarriage, flaps and nose-wheel steering. Two engine-alternators supply AC requirements. Hot-air de-icing of leading surfaces.

Powerplants
Two Napier Eland 504A (N.E1.6).
Take-off power each (I.S.A., s.l.): 3,500 at 12,500 r.p.m.
De Havilland four-blade propellers: 13 ft. 6 in. diameter.

Weights and Loadings
Basic operational: 32,980 lb.
Total fuel: 13,668 lb.
Mfrs. max. payload: 14,020 lb.
Max. take-off: 53,200 lb.
Max. landing: 50,670 lb.
Max. zero fuel: 47,000 lb.
Wing loading (max. t-o. wt.): 57.9 lb./sq. ft.
Wing loading (max. landing wt.): 55.1 lb./sq. ft.
Power loading (max. t-o. wt.): 7.60 lb./e.h.p.

Design Criteria
Design limits: Mc=0.486 (260 k.). Mne=0.54 (293 k.). Md=0.6 (352 k.).

Performance
Recommended cont. cruising speed (I.S.A.): 284 knots (at 20,000 ft. and 48,000 lb.); consumption 247 Imp. gal./hr.; power (per engine): 3,920 e.h.p.
Approach speed (at max. landing wt.): 100 knots.
Balanced field lengths (at max. t-o. wt.):
At I.S.A. at sea level: 4,650 ft.
At I.S.A. +15°C. at sea level: 5,350 ft.
At I.S.A. at 5,000 ft.: 6,100 ft.
Landing distance from 50 ft. (unfactored, max. landing wt.): 4,320 ft.
Range (take-off to landing), still air, no reserves, I.S.A., max. fuel (1,700 Imp. gal.): 1,860 naut. mi. with 6,552 lb. payload at 275 knots (mean) at 20,000 ft. (mean).
Range (take-off to landing) still air, no reserves, I.S.A., with max. payload 820 naut. mi.

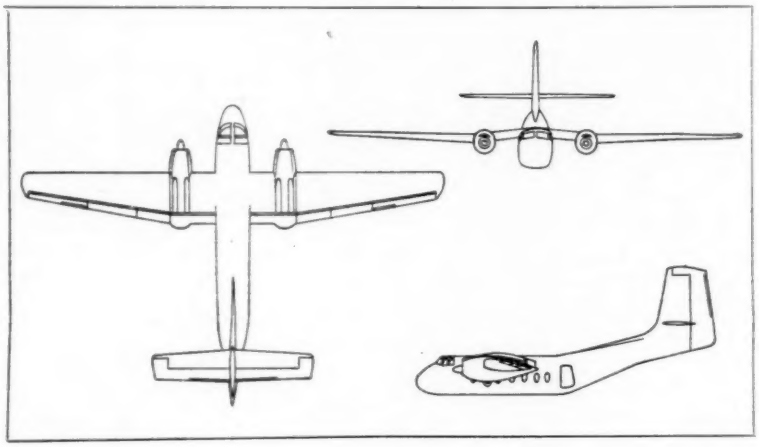


Commercial Aircraft . . . .

The de Havilland Caribou

CONSTRUCTED in the first instance in military guise, the DHC-4 Caribou is of considerable interest as a possible commercial freighter and utility passenger carrier—in which capacity it should be available in 1960. The design is a result of discussions between the Canadian de Havilland company, the U.S. Army and the Canadian Army which took place in 1956 on the basis of de Havilland design studies for an aeroplane in this category and known provisionally as the Twin Otter. Serious design work began in January, 1957, by which time the DHC-4 was substantially as it is to-day with the exception of a twin tail unit.

In this form, five Caribous were ordered by the U.S. Army for evaluation as utility cargo and personnel transports, and the Canadian Government signified its support for the project with an order for two. Construction of this batch of aircraft is now well in hand. Structure testing of the first partial airframe began in May and a complete programme covering all flight cases is to be covered. The first flying prototype (one of the aircraft for Canada) should be in the air by September, followed by the first for the U.S. Army quickly thereafter.



Broadly, the Caribou sets out to provide the capacity of a DC-3, combined with S.T.O.L. characteristics and direct rear loading into the fuselage. Within a gross weight of 24,000 lb., the Caribou takes a payload of 7,600 lb. over short ranges as a freighter. With conventional coach-class seating in a civil passenger rôle it will accommodate 27 passengers three-abreast; remembering that some DC-3s, with a narrower fuselage than the Caribou, provide four-abreast seating, this, presumably, could be increased for certain specific operations. Provision can be made for toilets and/or galley by reducing the seating capacity.

When operating in accordance with CAR 4b (to which standard the Caribou is being built) the take-off distance required is just over 2,000 ft. Using a short-field technique, in zero wind, the actual ground run is 490 ft. and the distance to 50 ft. (both engines operating) is 840 ft. The Caribou uses double-slotted flaps, of the type developed for the Otter, over the whole span, with the outer rear portion operating as ailerons; leading-edge flaps are also to be used.

The U.S. Army, which seems likely to order the Caribou in large quantities, has a stated interest in a developed version with Lycoming T55 turboprop engines. Work on this version is likely to proceed as soon as the preliminary flight trials have been completed.

Dimensions
Span: 96 ft. 0i n
Overall length: 68 ft. 10i n.
Overall height: 31 ft. 9 in.
Gross wing area: 912 sq. ft.
Sweepback: Nil.
Internal cabin dimensions:
Length (ex. flight deck): 25 ft. 0 in
Max width: 87 in.
Max. height: 75 in.
Max. usable floor area (ex. flight deck): 152 sq. ft.
Max. usable volume (ex. flight deck): 1,000 cu. ft.

Accommodation
Normal tourist: 27 (3 abreast).

Structure: Two-spar wing with conventional web spars, ribs, stringers and skin, in two outer panels attaching to one-piece centre section carrying engine nacelles. Bag tanks between spars. Frame and stringer square-section fuselage. Principal materials 24ST and 75ST aluminium alloy.

Undercarriage: Twin wheel main units forwards retracting, twin-wheel steerable nose-wheel, backward retracting. Hydraulic brakes.

Flaps: Full-span double slotted, and leading-edge flaps on outer panels.

Air Brakes: None.

Flying Controls: Fully manual system. Ailerons are trailing portion of outer flap sections. Trim tabs on all surfaces.

Systems: 3,000 p.s.i. hydraulic system for u/c, flaps, nose-wheel steering and brakes. 28V. DC electrics from two engine-driven generators and 3-phase 400V. 115 AC through rectifiers. No pressurization. Rubber boot de-icing on wing, fluid propeller de-icing, electric windshield de-icing. Gravity refuelling.

A model of the Caribou as it may appear in civil guise.

Powerplants
Two Pratt & Whitney R-2000-7M2.
Take-off power each (I.S.A., s.l.): 1,450 at 2,700 r.p.m.
Hamilton Standard c.s., f.f. 3-blade propeller, 13 ft. 1 in. diameter.

Weights and Loadings
Basic operational: 16,355 lb.
Total fuel: 5,040 lb.
Mfrs. max. payload: 6,800 lb.
Max. take-off: 24,000 lb.
Max. landing: 24,000 lb.
Max. zero fuel: 24,000 lb.
Wing loading (max. t-o. wt.): 26.3 lb./sq. ft.
Power loading (max. t-o. wt.): 8.3 lb.

Design Criteria
Design limits: Vc=182 k. Vne=219 k. Vd=243 k.

Performance
Recommended cont. cruising speed (I.S.A.): 154 knots (at 7,500 ft. and 24,000 lb.); consumption: 48.7 Imp. gal./hr.; power (per engine): 725 b.h.p.
Approach speed (at max. landing wt.): 67 knots.
Balanced field lengths (at max. t-o. wt.): At I.S.A. at sea level: 2,070 ft.
At I.S.A.+15°C. at sea level: 2,440 ft.
Landing distance from 50 ft. (unfactored, max. landing wt.): 1,000 ft.
Range (take-off to landing), still air, no reserves, I.S.A., max. fuel (700 Imp. gal.): 900 naut. mi. with 2,645 lb. payload at 130 knots (mean) at 7,500 ft. (mean).
Range (take-off to landing) still air, no reserves, I.S.A., with max. payload: 870 naut. mi.

Commercial Aircraft . . . .

The Sud-Aviation Caravelle

SUD-AVIATION have now moved into the production phase with the Caravelle, which is steadily gaining recognition as a short/medium-haul turbojet transport. The design dates back to 1951, when the "Moyen Courier" specification was drawn up, asking the French industry to develop an aircraft designed, broadly, for the Paris-North Africa routes, say 1,000 naut. miles, carrying a 6-7-ton payload at a block speed of 330 knots. Type and number of engines were left to the designers' choice.

The S.N.C.A.S.E. (as it then was) design team had already been studying a variety of transport projects, including turboprop and turbojet types and tailless and delta layouts, as well as more conventional swept-wing types. By July, 1952, the now classic Caravelle-type layout was selected and was submitted to the official departments concerned; on January 3, 1953, the contract for two prototypes was placed with the company. In the first instance, the use of three Atar turbojets was visualized, with one in the rear fuselage and an intake in the base of the fin; this arrangement was dropped, however, in favour of a twin-Avon installation when the 10,000 lb. s.t. R.A.26 became available.

The rear-fuselage location of the engines, selected after a great deal of discussion and study, largely dictated the general shape of the airframe. By-products of the engine position were an uninterrupted wing torsion-box and an aerodynamically clean wing, and the integral stairway for passenger loading at the rear, where there was already some local stiffening to support the thrust loads. Other features were the Comet-type front fuselage and flight deck and the leading edge wing flaps, which have since been replaced by a fixed leading-edge droop.

The Caravelle first flew on May 25, 1955, and after completing makers' flight trials this aircraft has been used by Air France in a 1,500-hour programme of freight operations for crew training and operating experience. A second prototype flew on May 6, 1956, soon after Air France had placed an order for 12 Caravelles, and this fully-furnished prototype has been widely used for demonstration flights, including a highly successful tour of South America and the U.S.A. Both these prototypes had Avon R.A.26 engines, but the production aircraft will have R.A.29s, as in the Comet 4.

Caravelles No. 3 and 4 are respectively

Dimensions
Span: 112 ft. 6 in.
Overall length: 105 ft. 0 in.
Overall height: 28 ft. 7 in.
Gross wing area: 1,579 sq. ft.
Sweepback: 20° on 25% M.A.C.
Internal cabin dimensions:
Length (ex. flight deck): 73 ft. 0 in.
Max. width: 118 5 in.
Max. height: 96 in.
Max. usable floor area (ex. flight deck): 646 sq. ft.
Max. usable volume (ex. flight deck): 4,485 cu. ft.

Accommodation
Normal first-class: 64 (4 abreast)
Normal tourist: 80 (5 abreast)
Volume of freight and baggage holds: 292 cu. ft. in two holds.

Structure: Torsion box wing structure with three spars forming integral fuel tanks, built in two pieces joined on fuselage centre line. Circular section monocoque fuselage.

Undercarriage: Four-wheel bogie main units retracting inwards into wing and fuselage, and twin-wheel steerable nose-wheel. Hydraulic brakes.

Flaps: Slotted flaps in four sections each side.

Air Brakes: Spoilers above and below each wing ahead of the flaps.

Flying Controls: Hydraulically-powered two-piece ailerons, rudder and elevator, with artificial feel.

Systems: Twin 2,500 p.s.i. hydraulic systems (each with electrically-powered standby) for u/c, wheel brakes, flaps, spoilers, nose-wheel steering, passenger door and feel simulation. Two engine-driven 30V. DC generators, providing 28.5V. DC and 115V. 400 cycle AC through two inverters; 26V. AC also through a transformer. De-icing of wings, tail unit and intakes by engine compressor air. Cabin pressurization at 8.05 p.s.i., by engine-bleed air via two blowers. Two-point pressure refuelling.

Powerplants
Two Rolls-Royce Avon 527.
Take-off power each (I.S.A., s.l.): 11,700 lb. at 8,000 r.p.m. Suppressors fitted.

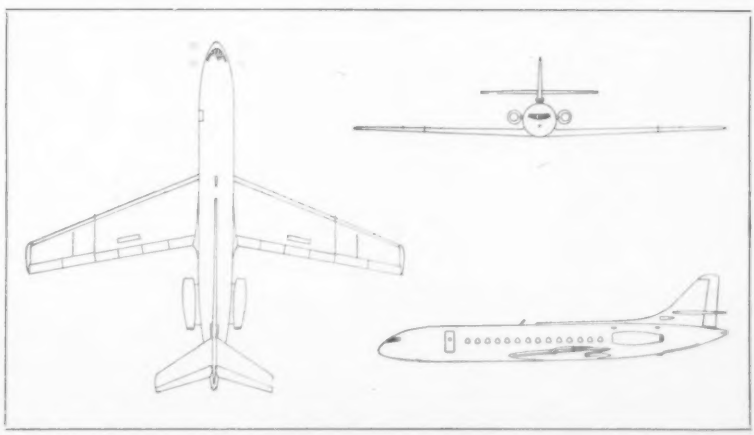
Weights and Loadings
Basic operational: 56,230 lb.
Total fuel: 33,000 lb.
Mfrs. max. payload: 18,250 lb.
Max. take-off: 97,000 lb.
Max. landing: 92,150 lb.
Max. zero fuel: 77,000 lb.
Wing loading (max. t.-o. wt.): 61.5 lb./sq. ft.
Wing loading (max. landing wt.): 58.4 lb./sq. ft.
Power loading (max. t.-o. wt.): 4.14 lb./lb. s.t.

Design Criteria
Design limits: Mc=.77 (300 k.), Mne=.81 (330 k.), Md=.84 (360 k.).

Performance
Recommended cont. cruising speed (I.S.A.): 446 knots (at 30,000 ft. and 80,000 lb.); consumption: 776 Imp. gal./hr.; thrust (per engine): 3,300 lb.
Approach speed (at max. landing wt.): 120.5 knots.
Balanced field lengths (at max. t.-o. wt.):
At I.S.A. at sea level: 5,600 ft.
At I.S.A. +15°C. at sea level: 6,300 ft.
At I.S.A. at 5,000 ft. 7,500 ft.
Landing distance from 50 ft. (unfactored, max. landing wt.): 3,330 ft.
Range (take-off to landing), still air, no reserves, I.S.A., max. fuel (4,070 Imp. gal.): 2,750 naut. mi. with 8,290 lb. payload at 418 knots (mean) at 37,000 ft. (mean).
Range (take-off to landing), still air, no reserves, I.S.A., with max. payload 1,800 naut. mi.

S.E. CARAVELLE

Customer	Quantity	Option	Announced value	Date of contract announcement	Delivery	Remarks
Air France	12	12	—	Spring, 1956	Starts Dec., 1958	Service early 1959
S.A.S.	12	13	£6m.	June 28, 1957	Jan.–Oct., 1959	Service in 1959
Varig	2	3	£5m.	Oct. 24, 1957	June–Nov., 1959	—
Finnair	3	—	—	Jan. 18, 1958	Feb.–April, 1960	—
Air Algérie	3	—	—	Mar. 13, 1958	Jan.-Mar., 1960	—



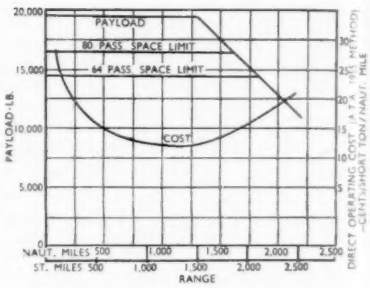
Commercial Aircraft . . . .

devoted to fatigue and structural testing, both programmes now being in hand at the E.A.T. in Toulouse as part of the certification schedule. The fatigue test is being made in a water tank in which each three-minute cycle represents a flight of just under three hours; four times a week, 300 cycles are made in 24 hours, to represent a 3,500-hour annual utilization per week. The initial programme covers an eight-year aircraft life; beyond this, tests will be made to establish the airframe's ultimate life and to prove the fail safe characteristics—by applying, for instance, gust loads in the areas of any fatigue cracks discovered.

Production of the Caravelle is being undertaken by a large group of factories, of which the most important are Sud-Aviation's own at Toulouse (for final assembly and flight test), Marignane, Bouguenais, Rochefort and St. Nazaire, together with the works of Latécoère, Fiat, Hispano Suiza and Forges de la Boissière. The first production aircraft for Air France has now flown and the rate of production is mounting to a planned peak of one a week by April, 1960. Sud-Aviation plan to deliver two aircraft to Air France by the end of this year, by which time the type certificate (to CAR 4b requirements) will have been obtained. Production plans at present cover 50 aircraft; by the time the 25th Caravelle is in this programme, the production cycle will be 20 months.

The production Caravelle has some small changes, including the Avon 522 (R.A.29) engines rated at present at 10,500 lb. s.t., in longer cowlings than hitherto, with suppressors; a glass-fibre spline along the fuselage to contain radio aerials; control "q-pots" relocated adjacent to the power jacks; and lengthened fuselage, by 4.6 ft., to provide one more seat row and weather radar.

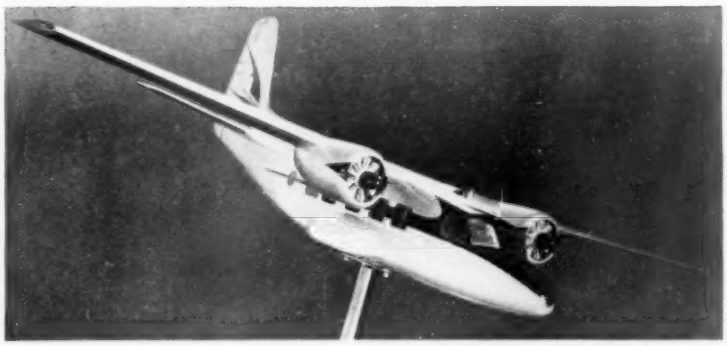
By 1960, the Avon R.A.30 (Stage III), with a two-position nozzle for full-thrust and cruising settings, will offer 11,700 lb. s.t., and these engines could be substituted in production Caravelles to increase the cruising speed to 430 knots or more (see tabulated data). In 1962, Rolls-Royce expect to have an Avon R.A.50 giving 12,500 lb. s.t. and improving the cruising speed to 453 knots. Sud-Aviation also consider that the Conway could be used in a developed Caravelle which would have a longer fuselage and would be economic over short stages cruising at 475 knots at 20,000 ft.



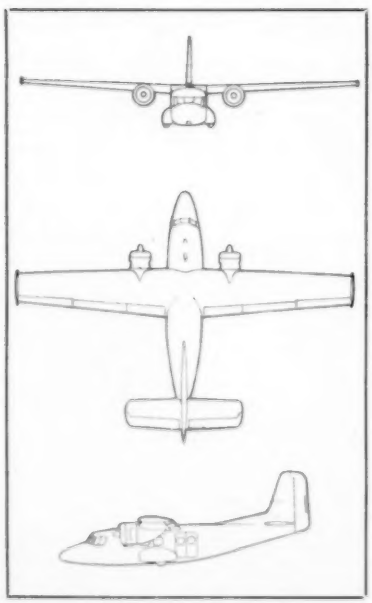
The MH-250 Super Broussard

EXPECTED to fly before the end of this year, the Max Holste Super Broussard has been developed as a light transport and freighter to complement the very successful single-engined Broussard which has been in production for the past five years. General characteristics and layout of the Super Broussard are shown here.

Both military and civil versions of the Super Broussard have been projected and layouts have been prepared for freight, ambulance, survey and agricultural versions, as well as 14-20-seat transports. The Turboméca Bastan turboprop is being studied as an alternative powerplant for later versions. The initial production version is powered by 600 b.h.p. Pratt & Whitney R-1340 radial engines.



Photograph copyright "The Aeroplane"



Max Holste are reported to be planning production of an initial batch of ten Super Broussards to meet orders from U.A.T., T.A.I. and Royal Air Maroc, and are offering delivery of the production aeroplane in September, 1959. Using the S.B.A.C. method, the company has estimated the direct operating cost to be 23d. per ton/naut. mile for an 800-km. stage length and 3,000-hr. utilization.

The MH-250 is of all-metal construction along classic lines, with fabric-covered control surfaces. The two 154-Imp.-gal. fuel tanks are in the wings, feeding header tanks located in the rear of the engine nacelles.

Dimensions

Span: 71 ft. 9½ in.
Overall length: 53 ft. 2 in.
Overall height: 20 ft. 10 in.
Gross wing area: 585 sq. ft.
Sweepback: Nil.
Internal cabin dimensions:
Length (ex. flight deck): 16 ft. 8 in.
Max. width: 85 in.
Max. height: 77 in.
Max. usable floor area (ex. flight deck): 114 sq. ft.
Max. usable volume (ex. flight deck): 706 cu. ft.

Accommodation

Normal first-class: 14 (3 abreast).
Normal tourist: 17–20 (3 abreast).
Volume of freight and baggage holds: 113 cu. ft.(1)

Powerplants

Two Pratt & Whitney R-1340-S3H1-G.
Take-off power each (I.S.A., s.l.): 600 b.h.p.
Ratier or Hamilton Standard three-blade c.s. propellers.

Weights and Loadings

Basic operational: 10,010 lb.
Total fuel: 1,146 lb.
Mfrs. max. payload: 4,650 lb.
Max. take-off: 14,590 lb.
Max. landing: 14,590 lb.
Wing loading (max. t-o. wt.): 24.9 lb./sq. ft.
Power loading (max. t-o. wt.): 12 lb./h.p.

Performance

Recommended cont. cruising speed (I.S.A.): 136 knots (at 9,840 ft. and 14,550 lb.); power (per engine): 250 h.p.
Approach speed (at max. landing wt.: 71.5 knots.
Take-off distance to 50 ft., two engines, 15° flap (at max. t-o. wt.):
At I.S.A. at sea level: 1,296 ft.
At I.S.A. + 30°C. at sea level: 1,380 ft.
At I.S.A. at 5,000 ft.: 1,805 ft.
Landing distance from 50 ft. (unfactored, max. landing wt.): 1,610 ft.
Range (take-off to landing), still air, no reserves, I.S.A., max. fuel (308 Imp. gal.): 1,080 naut. mi. with 3,000 lb. payload at 145 knots (mean) at 9,840 ft. (mean).
Range (take-off to landing), still air, S.B.A.C. reserves, I.S.A., with max. payload: 125 naut. mi.

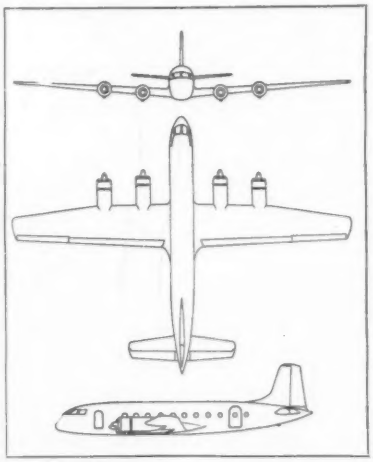
Commercial Aircraft . . . .

The Agusta AZ-8L

THE AZ-8L is the latest product of Costruzioni Aeronautiche Giovanni Agusta, completed a few weeks ago and flown for the first time on June 9. Its construction has been financed by the Italian Air Ministry although it is intended primarily for commercial use as a feeder-liner. The company have adopted the four-engined layout, using engines of comparatively low power, as being preferable, in view of current certification requirements, to the more classic twin-engined formula for an aeroplane of this class.

Best economy is obtained over ranges of 350-450 naut. miles, a figure of 16.5d. per short ton-nautical mile having been calculated by the manufacturers according to S.B.A.C. method.

Conventional all-metal structure is used with a single-spar wing, a false rear spar completing the torsion circuit and carrying the ailerons and flaps. The wing is in three sparnwise sections.



Dimensions
- Span: 83 ft. 8 in.
- Overall length: 63 ft. 9 in.
- Overall height: 21 ft. 8 in.
- Gross wing area: 719 sq. ft.
- Sweepback: Nil.
- Internal cabin dimensions:
  - Length (ex flight deck): 44 ft. 3 in.
  - Max. width: 65 in.
  - Max. height: 75 in.
  - Max. usable floor area (ex flight deck): 213 sq. ft.
  - Max. usable volume (ex flight deck): 1,174 cu. ft.

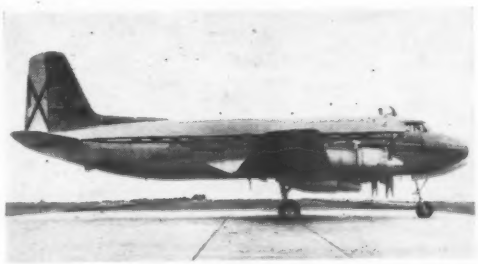
Accommodation
- Normal first-class: 22 (2 abreast).
- Normal tourist: 26 (2/3 abreast).

Powerplants
- Four Alvis Leonides 502/5.
- Take-off power each (I.S.A., s.l.): 540 at 3,000 r.p.m.
- de Havilland XPB13250 three-blade propellers, 9 ft. diameter.

Weights and Loadings
- Basic operational: 16,800 lb.
- Total fuel: 4,700 lb.
- Mfrs. max. payload: 6,250 lb.
- Max. take-off: 24,900 lb.
- Max. landing: 23,800 lb.
- Max. zero fuel: 22,700 lb.
- Wing loading (max. t-o. wt.): 34.6 lb./sq. ft.
- Wing loading (max. landing wt.): 33.2 lb./sq. ft.
- Power loading (max. t-o. wt.): 11.5 lb./b.h.p.

Performance
- Recommended cont. cruising speed (I.S.A.): 200 knots (at 9,850 ft.).
- I.C.A.O. field lengths (at max. t-o. wt.) (three engines):
  - At I.S.A. at sea level: 2,200 ft.
  - At I.S.A. at 3,000 ft.: 2,300 ft.
- Landing distance from 50 ft. (unfactored, max. landing wt.): 2,750 ft.
- Range (take-off to landing), still air, S.B.A.C. reserves, I.S.A., max. fuel (650 Imp. gal.): 1,350 naut. mi. with 3,240 lb payload at 200 knots (mean) at 9,920 ft. (mean).
- Range (take-off to landing), still air, no reserves, I.S.A., with max. payload: 350 naut. mi.

The CASA 207



THE CASA 207 is the latest in a series of twin-engined transports designed and produced by Construcciones Aeronáuticas Sociedad Anonima at Madrid. It was first flown on September 28, 1955, and a production batch of 10 is now under construction.

In the project stage is the CASA 209, derived from the 207 and powered by two Napier Eland or alternative turboprop engines. This same design is also being developed in Germany by Hamburger Flugzeugbau and a note appears on page 46 under the heading HFB 209.

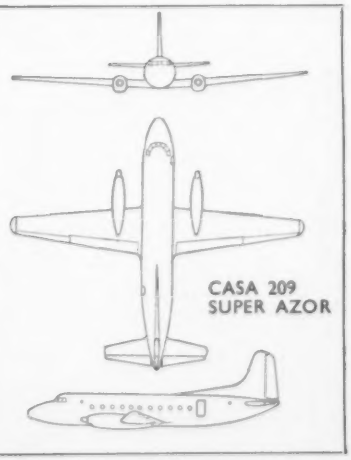
Dimensions
- Span: 91 ft. 2 in.
- Overall length: 68 ft. 5 in.
- Overall height: 25 ft. 5 in.
- Gross wing area: 924 sq. ft.
- Sweepback: Nil.
- Internal cabin dimensions:
  - Length (ex flight deck): 38 ft. 0 in.
  - Max. width: 88 in.
  - Max. height: 76 in.
  - Max. usable floor area (ex flight deck): 237 sq. ft.
  - Max. usable volume (ex flight deck): 1,625 cu. ft.

Accommodation
- Normal first-class: 30 (3 abreast).
- Normal tourist: 40 (4 abreast).
- Volume of freight and baggage holds: None.

Powerplants
- Two Bristol Hercules 730.
- Take-off power each (I.S.A., s.l.): 2,040 at 2,800 r.p.m.
- de Havilland 4/4000/6 four-blade propellers, 12 ft. 9 in. diameter.

Weights and Loadings
- Basic operational: 22,786 lb.
- Total fuel: 7,430 lb.
- Mfrs. max. payload: 6,420 lb.
- Max. take-off: 34,500 lb.
- Max. landing: 33,950 lb.
- Max. zero fuel: 31,500 lb.
- Wing loading (max. t-o. wt.): 37.3 lb./sq. ft.
- Wing loading (max. landing wt.): 35.8 lb./sq. ft.
- Power loading (max. t-o. wt.): 8.5 lb./b.h.p.

Performance
- Recommended cont. cruising speed (I.S.A.): 247 knots (at 9,100 ft. and 34,500 lb.); consumption: 144 Imp. gal./hr.; power (per engine): 1,200 b.h.p.
- Approach speed (at max. landing wt.): 102 knots.
- Take-off distance to 50 ft. (at max. t-o. wt.):
  - At I.S.A. at sea level: 2,700 ft.
  - At I.S.A. at 5,000 ft.: 3,150 ft.
- Landing distance from 50 ft. (unfactored, max. landing wt.): 3,130 ft.
- Range (take-off to landing), still air, no reserves, I.S.A., max. fuel (740 Imp. gal.): 1,600 naut. mi. with 4,850 lb. payload at 205 knots (mean) at 6,550 ft. (mean).
- Range (take-off to landing), still air, no reserves, I.S.A., with max. payload: 600 naut. mi.



Commercial Aircraft . . . .

Antonov An-10A Ukraine

FIRST flown in the early spring of 1957, the Ukraine is now in production at an engineering collective in the Ukraine. About a dozen examples had flown by March, 1958, and the type is expected in service by the end of this year on the domestic routes of Aeroflot.

The task given the design bureau headed by Oleg K. Antonov was to produce a short-medium haul "workhorse" transport, able to operate from small, unprepared fields and having low operating costs. The four-turboprop layout selected itself for this mission, but the special design requirements are reflected in the high wing, to keep the propellers clear of debris, and the undercarriage arrangement with its low-pressure tyres. Although rather less sophisticated than the Il-18 Moscow, the Ukraine has several Western-style features, noticeable especially in the interior layout and accommodation which has been styled by Antonov's bureau rather than by Aeroflot.

ANTONOV An-10A

Dimensions
Span: 124 ft. 8 in.
Overall length: 121 ft. 4 in.
Overall height: 32 ft. 1 in.
Gross wing area: 1,293 sq. ft.
Sweepback: Nil on main spar.
Internal cabin dimensions:
Max. height: 108 in.
Max. usable volume (ex. flight deck): 7,840 cu. ft.

Accommodation
Normal first-class: 84 (5 abreast)
Normal tourist: 100 (6 abreast)
Max. coach: 126 (6 abreast)
Volume of freight and baggage holds: 1,483 cu. ft.

Structure: Two-spar wing in five sections including centre section through fuselage. Fuel tanks in wings. Circular-section monocoque fuselage.

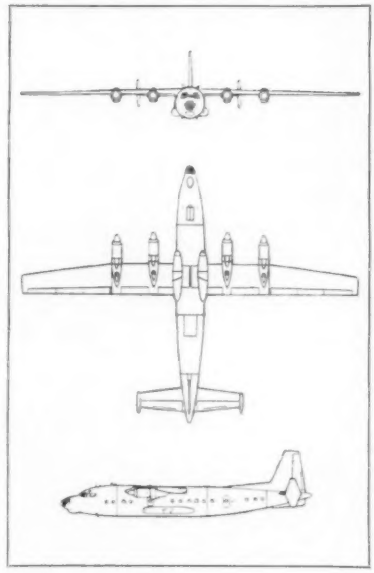
Undercarriage: Four-wheel bogie main units, retract upwards into fuselage-side housings. Twin-wheel steerable nose-wheel.

Flaps: Double-slotted type, in two portions on each wing.

Air Brakes: None.

Flying Controls: Fully manual system with aerodynamically-balanced ailerons, elevators and rudder.

Systems: Duplicated 2,100 p.s.i. hydraulic system for u/c, brakes, flaps, nose-wheel steering and windscreen wipers, with manual system for ground use with engines stopped. Cabin pressurization 7.1 p.s.i. by compressor-bled air. Electro-thermal de-icing of wing, tailplane, fin, propellers, intakes and windscreen.



Powerplants
Four Ivchenko AI-20 turboprops.
Take-off power each (I.S.A., s.l.): 4,000 e.h.p.
Four-blade, 14.8 ft. diameter reversing propellers.

Weights and Loadings
Total fuel: 22,600 lb.
Mfrs. max. payload: 32,000 lb.
Max. take-off: 121,500 lb.
Wing loading (max. t-o. wt.): 88 lb./sq. ft.
Power loading (max. t-o. wt.): 7.2 lb./e.h.p.

Performance
Recommended cont. cruising speed (I.S.A.): 345 knots (at 26,000 ft.)
Take-off run: 2,130–2,300 ft.
Landing run: 1,640 ft.
Range (take-off to landing), still air, 1-hr. fuel reserve, I.S.A., max. fuel (2,800 Imp. gal.): 1,850 naut. mi. with 18,600 lb.
Range (take-off to landing) still air, 1-hr. fuel reserve, I.S.A., with max. payload: 1,080 naut. mi.

Data based on Russian figures, April, 1958.

The large wing, with double-slotted flaps to improve the take-off performance, is built in five portions—a centre section running through the fuselage, two intermediate sections carrying the engines, and two outer planes. Notable features of the circular section fuselage are its great girth—13½ ft.—and the cabin headroom of 9 ft. A rear-loading ramp has been designed into the fuselage, in keeping with the essentially utilitarian rôle of this aircraft, and suggesting that a freight version may be planned. Since the An-10 first appeared, one illustration has shown the additional fin area depicted in the general arrangement drawing here, but this may be only a temporary modification.

Prototypes of the An-10 were powered by Kuznetsov NK-4 turboprops of 4,000 e.h.p., but the production model, designated An-10A, has a newer engine, the Ivchenko AI-20, of similar power but lower consumption.

The voluminous cabin of the Ukraine permits a variety of layouts, of which one, shown in the prototype, was for 83 passengers in a predominantly five-abreast arrangement, plus six in a special V.I.P. cabin. This layout also includes a large cloakroom, two toilets, a galley and baggage accommodation. Standard seating seems to be for 100 passengers six-abreast. The design has also been stretched—by 9 ft. 10 in.—to produce a 130-seat version which is designated the An-16. This also has a slightly modified fuselage to increase the size of the underfloor freight hold.

The An-10A is operated by a flight crew of four, of which the navigator sits in the extreme nose where he has a table and weather radar scanner to starboard and radio console to port. The radar itself is carried in a fairing under the nose. Pilots are side-by-side on the flight deck with the fourth crew seat behind and on a lower level.

Commercial Aircraft . . . .

Ilyushin Il-18 Moscow

THERE are good reasons for thinking that the Ilyushin Il-18 Moscow conforms more closely to Western ideas than any other contemporary Russian turbine transport. Sergei Ilyushin's design bureau, like that headed by Oleg Antonov, appears to have made a conscious and successful attempt to provide an aeroplane which is comparable in engineering detail, standard of accommodation and performance, with the types under development in Britain and the U.S.A. Moreover, the Moscow has a significant lead, chronologically, over the Vanguard and Electra. It was first shown publicly in Moscow on July 10, 1957, design work probably having begun some two years earlier, and production has since been initiated at Plant No. 30 at Vnukovo, Moscow.

Several examples of the Moscow were flying by the Spring of 1958, and in March, Moscow radio reported the completion of acceptance and evaluation trials, which had been undertaken by Aeroflot. The initial flight trials were made by Vladimir Kokkinaki. Intended for medium-range trunk routes, the Moscow is expected to be in service with Aeroflot soon, initially on the Moscow—Leningrad and Moscow—Vladivostock routes, and will probably appear on international as well as domestic routes.

Design of the Moscow is conventional and, as on all the new Aeroflot equipment except the Tu-114, the control system is wholly manual. Tapered skin is used on the wing panels, but there is no evidence of integral machining. Titanium sheet is used in the region of the jet pipes, which are carried over the top surface of the wing, and in the wheel wells. The fuel tankage at present comprises bag tanks in the one-piece wing-centre section and integral tanks between spars in the outer wings; capacity totals 5,280 Imp. gallons; a version with integral centre tanks is also planned and will have a capacity of 5,940 Imp. gallons.

Standard accommodation in the Moscow is for 75 passengers, 10 in a forward compartment and 65 in the main cabin, with the galley between. The entrance vestibule is at the rear, with the two toilets at the extreme end of the pressurized area. A model of a 100-seat variant of the Il-18 was shown at the Brussels Universal Exhibition. Westernization of the Moscow design extends to the use of port-side passenger loading doors (instead of the usual Russian starboard doors), plastic cabin lining and foam-plastics seat filling. Passenger services are located at each seat row in the luggage rack fairing.

Provision is made for a flight crew of five—two pilots, navigator, radio operator and flight engineer—and the Moscow is the first of the new generation of Russian types to dispense with the visual navigator's station in the nose. Navigation aids are reported to include the NI-50BM-3 (a Decca-type equipment) and Emblema weather radar in addition to ILS, twin ADF, radio altimeter and marker beacon receivers. HF and twin VHF radio is fitted.

ILYUSHIN Il-18

Dimensions
- Span: 122 ft. 8 in.
- Overall length: 117 ft. 0 in.
- Overall height: 33 ft. 5 in.
- Gross wing area: 1,507 sq. ft.
- Sweepback: Nil on mainspar.
- Internal cabin dimensions:
  - Length (ex. flight deck): 92 ft. 0 in.
  - Max. height: 78 in.
  - Max. usable volume (inc. flight deck): 8,830 cu. ft.

Accommodation
- Normal first-class: 75 (5 abreast).
- Normal tourist: 100 (5 abreast).
- Volume of freight and baggage holds: 1,590 cu. ft.

Structure: Three-spar main wing section, 72-ft. span, and two-spar extension planes. Integral tanks between spars in outer planes, bag tanks in centre section. Circular-section monococque fuselage.

Undercarriage: Four-wheel bogie main units, backward retracting into inboard nacelles, and twin-wheel steerable nose-wheel.

Flaps: Single-slotted in one piece on each wing.

Air Brakes: None.

Flying Controls: Aerodynamically-balanced manual ailerons, elevators and rudder; trim tabs on elevator and rudder, spring tab on rudder only.

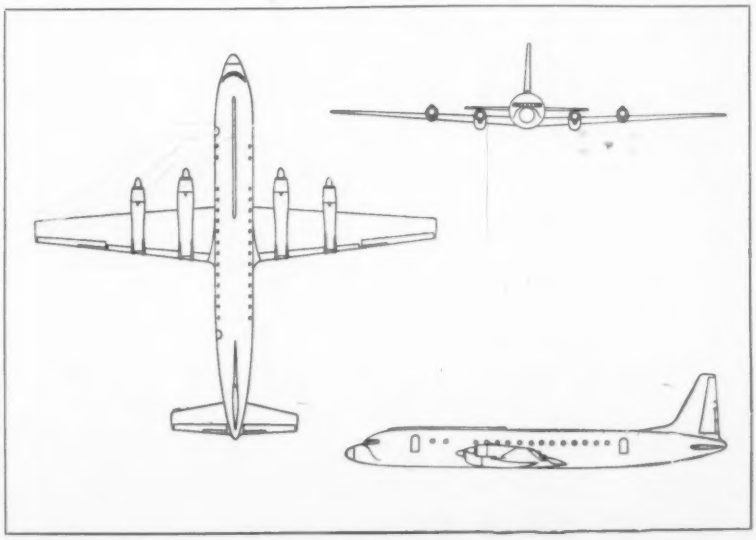
Systems: 3,000 p.s.i. hydraulic system with two pumps and two 2,100 p.s.i. stand-by nitrogen-charged accumulators, for u/c, brakes, flaps, nose-wheel steering and windscreen wipers. Eight 12 kVA engine-driven alternators generating at 115V; starter-generators provide 28V DC and batteries supply 24V DC. Cabin pressurization 7.1" p.s.i. by compressor-bled air. Electro-thermal de-icing of wing, fin, tailplane, propellers, spinners, intakes and windscreen.

Powerplants
- Four Kuznetsov N.K.4 turboprops.
- Take-off power each (I.S.A., s.l.): 4,000 e.h.p.
- AB-68B four-blade reversing propellers, 13.7-ft. diameter.

Weights and Loadings
- Empty: 61,730 lb.
- Total fuel: 42,770 lb.
- Mfrs. max. payload: 30,900 lb.
- Max. take-off: 127,870 lb.
- Wing loading (max. t-o. wt.): 84.9 lb./sq. ft.
- Power loading (max. t-o. wt.): 7.93 lb./e.h.p.

Performance
- Recommended cont. cruising speed (I.S.A.): 350 knots (at 26,250 ft.).
- Take-off distance to 50 ft.: 2,460–2,950 ft.
- Landing distance from 50 ft.: 1,640–1,970 ft.
- Range (take-off to landing), still air, 1½ hr. fuel reserve, I.S.A., max. fuel (5,280 Imp. gal.): 2,700 naut. mi.
- Range (take-off to landing), still air, 1½ hr. fuel reserve, I.S.A., with max. payload: 1,615 naut. mi.

Data based on Russian figures, April, 1958.



Commercial Aircraft . . . .

The Tupolev Tu-104

RUSSIA'S first (and the World's second) commercial turbojet aircraft, the Tu-104, went into regular service on September 15, 1956, on the 2,400 naut. mile Moscow-Omsk-Irkutsk route. Since that date, it has become firmly established in service on trunk routes within Russia, and also on the more important Aeroflot international services, such as those to Peking, Prague and Copenhagen. More recent events of interest have been the appearance of the Tu-104A in July, 1957, the establishment of a series of records in the autumn of 1957, and the delivery of the first export Tu-104As to Czechoslovakia, in November, 1957.

The date on which design work started is not known, but the development period was shortened by use of many components from the Tu-16 (Badger) bomber already in production for the Soviet Air Force. The first flight was made in mid-1955, production having been previously initiated, and there followed a period of intensive proving flying and crew familiarization. About two dozen Tu-104s were available by September, 1956, and at least 75 are believed to be in service now.

Because of its military background, the Tu-104 is still subject to Soviet security restrictions so far as construction, weights and performance are concerned and few figures have been published in Russia. Development of the aircraft was undertaken in the 1950-55 Five Year Plan primarily to give Aeroflot a prestige transport and there is little doubt that the later turboprop types and the Tu-110 will in due course figure more prominently in Aeroflot's fleet than the Tu-104. The two big Mikulin turbojets, inherited from the Tu-16, make the Tu-104's economy poor enough to cause even Aeroflot some concern and led to development of the Tu-104A, with its lower seat-mile costs.

The TU-104A has standard accommodation for 70 passengers, made up of 16 "first-class" seats four-abreast forward, and 54 "tourist-class" seats in the main rear cabin. This compares with the 50 seats in the Tu-104—14 forward and 36 four-abreast in the main cabin. A feature of all the Tu-104 series is the strangely old-fashioned interior décor, which apparently is an Aeroflot standard against which Antonov and Ilyushin, but not Tupolev, have revolted. Reading lights are in the seat backs and individual passenger oxygen masks are stowed in the seat pockets.

The Tu-104A differs also in having modified engines (by Zubets) of lower fuel consumption, and a number of detail engineering refinements, none of which is obvious from external examination of the aircraft. An indication of ultimate performance of the Tu-104A was given last September in a series of load-carrying and speed records, in the course of which, according to F.A.I. data, a payload of 44,213 lb. was carried to a height of 36,814 ft.; a payload of 4,410 lb. was carried over 1,077 naut. miles at 485 knots and a payload of 22,046 lb. was carried over 538 naut. miles at 524 knots.

The Tu-104s are operated by a flight crew of four or five—two pilots, radio operator (facing aft), engineer (optional) on the flight deck and navigator in the transparent nose position. Weather radar is carried in a fairing under the nose and other electronic equipment includes VHF and HF radio and ILS. A radio altimeter and probably the Russian Decca-type navigation aid are also fitted.

The heading photograph, recently arrived from Russia, shows three Tu-104s on the ramp at Vnukovo—with the customary cluster of Il-14s behind. Another Tu-104 was in the news recently when it visited Vancouver for the British Columbia centennial air show, flying in direct from eastern Russia.

TUPOLEV Tu-104

Powerplants
Two Mikulin AM-3 (RD-3).
Take-off power each (I.S.A., s.l.): 19,180 lb. at 4,700 r.p.m.

Weights and Loadings
Total fuel: 60,000 lb.
Mfrs. max. payload: 19,500 lb.
Max. take-off: 164,250 lb.
Max. landing: 141,000 lb.
Wing loading (max. t-o. wt.): 90 lb./sq. ft.
Wing loading (max. landing wt.): 77 lb./sq. ft.
Power loading (max. t-o. wt. : 4.2 lb./lb.s.t.

Design Criteria
Max. coefficient of lift: 1.85.
Design limits: Mne=0.95.

Performance
Recommended cont. cruising speed (I.S.A.): 440 knots.
Approach speed (at max. landing wt.): 144 knots.
Range (take-off to landing), still air, no reserves, I.S.A., max. fuel (7,470 Imp. gal.): 2,430 naut. mi.

Data estimated or deduced.

Dimensions
Span: 114 ft. 10 in.
Overall length: 121 ft. 4¼ in.
Overall height: 39 ft. 4½ in.
Gross wing area: 1,825 sq. ft.
Sweepback: 36° on quarter-chord line.
Internal cabin dimensions:
Max. width: 126 in.

Accommodation
Normal (Tu-104): 50 (4 abreast).
Normal (Tu-104A): 70 (4 and 5 abreast).

Structure: Two-spar wing in two main units joined by a fuselage-width centre section. Circular-section monocoque fuselage.

Undercarriage: Four-wheel bogie main units, retracting up and back into wing nacelles; twin-wheel steerable nose-wheel. Triple cluster braking parachute fitted.

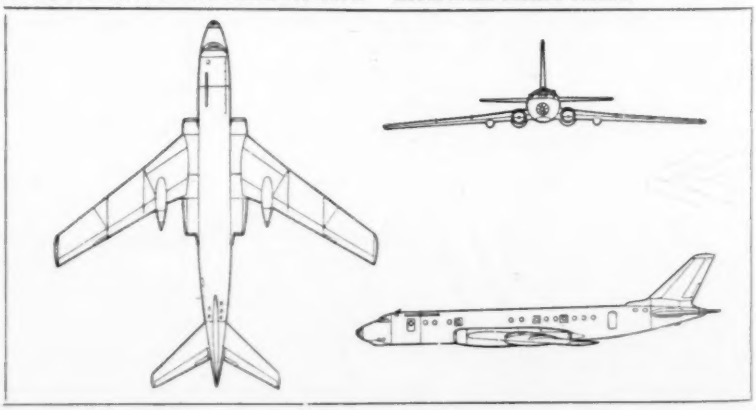
Flaps: Fowler-type in two portions on each wing.

Air Brakes: None.

Flying Controls: Fully manual ailerons, elevator and rudder.

Systems: Thermal de-icing of wing leading edge by engine-bled air. Cabin pressurization 7.2 p.s.i.

Data estimated or deduced.



Commercial Aircraft . . . .

Tupolev Tu-110

THE Tu-110 made its public début at Vnukovo on July 10, 1957, when it was seen to be a slightly "stretched," four-engined version of the Tu-104. Its development—by G. C. Markov, a deputy director of the Tupolev design bureau—was presumably intended to improve on the operating economy of the Tu-104 and took advantage of the availability of the smaller, 12,000 lb. Lyulka turbojets.

The four engines are carried in a centre section, and are tied to the spar and wing ribs, whereas the AM-3s in the Tu-104 are mounted onto the fuselage frames. The new centre section increases the overall span by 8 ft., although the wing panels outboard of the engines, and including the undercarriage nacelles, are similar to those of the Tu-104. The flaps have been modified by increasing the chord of those on the outer panels and adding new centre-section flaps.

Accommodation in the Tu-110 has been increased to a maximum of 100 passengers, the extra capacity being obtained by introducing an additional 4-ft. section forward of the wing. The 100-passenger version has five-abreast seating throughout in three cabins; an alternative variant seats 78 passengers in greater comfort and a de luxe layout has been prepared for 50 passengers. The cabin floor is reported to have been raised by 5½ in. and the freight hold floor lowered by 2.8 in. to increase the total capacity of the two freight holds to 988 cu. ft.

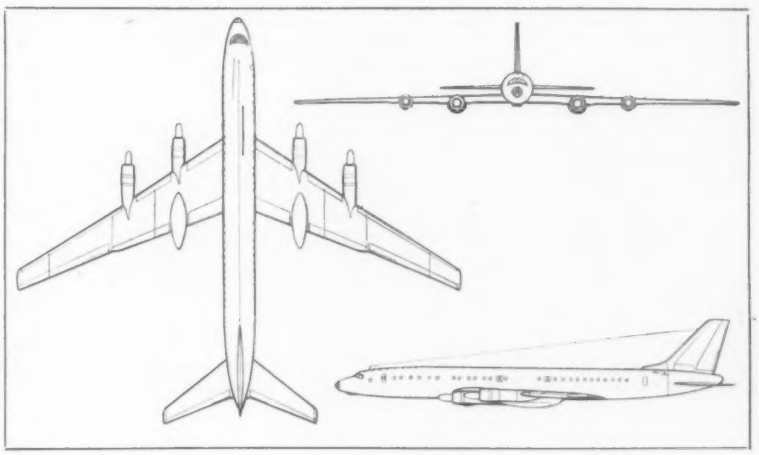
The Tu-110 is believed to be in production for use on Aeroflot's domestic and international routes. Russian figures for the Tu-110 appear to be rounded off to the nearest hundred in metric units and quote a maximum payload of 26,455 lb. over a range of 1,780 naut. miles (with 1-hr. fuel reserve) cruising at 430 knots at 32,000-39,000 ft. Over short ranges a high-speed cruise at 485 knots can be used.

Tupolev Tu-114

PROBABLY the biggest commercial aircraft flying anywhere, the Tu-114 Russia has been developed, like Tupolev's jet transports, from a bomber already in production for the Soviet Air Force (the Tu-95 "Bear"). Because of these military connections, and the early stage in its development as a commercial type, the Tu-114 has not been made the subject of as much publicity as some of the other Russian types, and some detailed specifications which appeared in a Polish journal in January are not thought to be reliable.

The first appearance of the Tu-114 was timed to coincide with the celebration of the 40th anniversary of the Soviet Revolution, in October, 1957, and there is some doubt whether it had made its first flight at that time. Photographs and a film showing the prototype in the air were released in February, 1958.

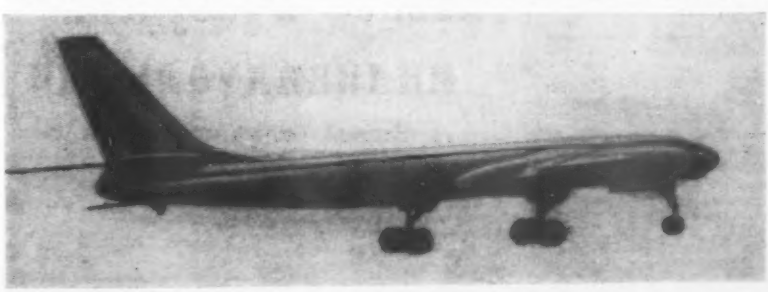
The Tu-114 has a span of approximately 180 ft. and a length of about 155 ft. The gross weight is not likely to be less than 400,000 lb. Engines, like those in the Tu-95 bomber, are Kuznetsov NK-12s rated at 12,000 s.h.p. each plus 2,645 lb. jet thrust for take-off at sea level. These engines were developed originally by a group of ex-Junkers engineers working in Russia, between 1950 and 1952; design of the Tu-95 began also in 1950. A contra-prop of about 17 ft. diameter is used. Maximum speed of the bomber is thought to be about 470 knots; the Tu-114 is probably rather slower, and might cruise at about 420 knots.



The lines of the fuselage and tail unit closely resemble the Tu-104, but on a larger scale, the outside diameter probably being of the order of 15 ft. Several layouts have been prepared for the Tu-114, including one which provides for 220 passengers in a mixture of six, seven and eight abreast seating. A model at the Brussels International Exhibition showed 170 seats including 41 in the forward cabin, 48 in a central "restaurant" cabin, three in a small private compartment amidships, 24 in four six-seat pullman compartments each containing two berths, and 54 in the aft cabin. Under the cabin floor are two enormous freight holds, divided by a "kitchen" connected to the cabin by a staircase. Gross pressurized volume is 20,120 cu. ft., including 16,420 cu. ft. in the cabin and 2,470 cu. ft. in the underfloor freight holds. The cabin differential pressure is 8.4 p.s.i., and an emergency oxygen system with individual passenger masks is provided.

Arrangement on the flight deck is like that in the Tu-104, with two pilots, aft-facing radio operator, engineer, and navigator in the glazed nose. The long twin nosewheel leg retracts backwards to lie under the flight deck and forward cabin floor, and the four-wheel main undercarriage bogies fold up and back into housings at the rear of the inner nacelles. The Tu-114 is apparently unique among the current Russian transport types in having powered controls, with artificial feel.

In May of this year, some details were released of a variant known as the Tu-114D (shown in the photograph here). This appears to have a fuselage of better fineness ratio and reduced capacity; the tailplane has been relocated on the fin. The Tu-114D has flown a round trip Moscow-Irkutsk-Moscow, a distance of 4,640 naut. miles, non-stop, and flew the 3,460 naut. miles from Moscow to Vladivostok in 9 hr.

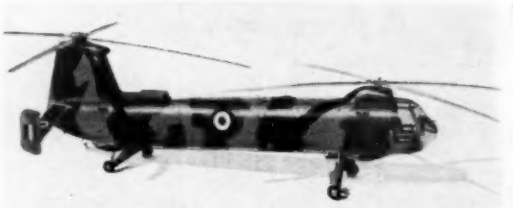


Commercial Helicopters

The Bristol 192C

ALTHOUGH at present only a military version of the Bristol Type 192 can be considered as a certainty in terms of development prospects, this twin-engined, twin-rotor helicopter has obvious civil applications and reference has been made from time to time to this version as the 192C. If all goes well it may be that this civil helicopter will be used by B.E.A. early in the 1960s for preliminary inter-city or other scheduled airline operations.

The figures for the military version with two Napier Gazelle Series 2 turbines are given in the accompanying table. The engines have a maximum emergency power of 1,650 s.h.p. each, but for twin-engined operations the output will be limited to 920 s.h.p. each. The still-air range, at 2,000 ft. in I.S.A. conditions and assuming 100 lb. of fuel for run-up and take-off and 20% cruise fuel as reserve, is of the order of 620 n.m. when extra tanks are installed, or of 400 n.m. with normal tankage and 10 passengers.



A model of the Gazelle-engined Bristol 192 in military insignia.

Photograph copyright "The Aeroplane"

The Fairey Rotodyne prototype in flight.

BRISTOL 192

Dimensions
- Rotor diameter: 48 ft. 8 in.
- Overall length: 89 ft. 9.25 in.
- Overall height: 17 ft.
- Disc area (each rotor): 1,860 sq. ft.

Powerplants
- Two Napier Gazelle Series 2.
- Emergency power each (I.S.A., s.l.): 1,650 s.h.p., limited to 920 s.h.p. each for twin-engined operations. Driving two four-blade rotors. Max. rotor speed: 270 r.p.m.

Weights and Loadings
- Total fuel: 4,480 lb. (560 Imp. gal.).
- Mfrs. max. payload: 6,000 lb.
- Max. take-off: 18,000 lb.
- Disc loading (max. t-o. wt.): 8.83 lb./sq. ft.
- Nominal twin-engine power loading (max. t-o. wt.): 9.8 lb./s.h.p.

Performance
- Recommended cont. cruising speed (I.S.A.): 120 knots (at sea level and 18,000 lb.).
- Service ceiling: 13,250 ft.
- Hovering ceiling: 8,000 ft.
- Vertical rate of climb (nominal twin-engine power): 500 ft./min.
- Optimum rate of climb (nominal twin-engine power): 1,175 ft./min.
- Typical ranges, still air, 20% cruise fuel reserves, I.S.A.: 168 naut. mi. with 4,500 lb. payload at 120 knots at 2,000 ft.; or 280 naut. mi. with 3,000 lb. payload.

ROTODYNE

Dimensions
- Span: 46 ft. 6 in.; Rotor dia.: 90 ft. 0 in.
- Overall length: 58 ft. 8 in.
- Overall height: 22 ft. 2 in.
- Gross wing area: 475 sq. ft. Gross disc area 6,360 sq. ft.
- Internal cabin dimensions:
  - Length (ex. flight deck): 46 ft. 0 in.
  - Max. width: 96 in.
  - Max. height: 72 in.
  - Max. usable floor area (ex. flight deck): 360 sq. ft.
  - Max. usable volume (ex. flight deck): 2,100 cu. ft.

Accommodation
- Normal first-class: 40 (4 abreast)
- Normal tourist: 48 (4 abreast)

Powerplants
- Two Napier Eland N.El.7 turboprops and Fairey rotor-tip pressure jets.
- Take-off power each (I.S.A., s.l.): 3,500 e.h.p. at 12,500 r.p.m.
- Rotol 13 ft. diameter four-blade constant-speed propellers.

Weights and Loadings
- Basic operational: 24,000 lb.
- Total fuel: 7,500 lb.
- Mfrs. max. payload: 15,000 lb.
- Max. take-off: 39,000 lb.
- Max. landing: 39,000 lb.

Performance
- Recommended cont. cruising speed (I.S.A.): 160 knots (at 3,000 ft. and 39,000 lb.).
- Range (take-off to landing), still air, no reserves, I.S.A., max. fuel (925 Imp. gal.): 520 naut. mi. with 7,500 lb. payload at 160 knots (mean) at 3,000 ft. (mean).

The Fairey Rotodyne

UNIQUE as a VTOL aircraft, the Rotodyne is, in effect, a tip-jet-powered helicopter during the take-off and landing phases, and a combination of Autogiro and fixed-wing aircraft during the remainder of its flight régime. Its two Napier Eland turbine powerplants drive compressors to supply air to the rotor-tip jets and provide normal propeller-power for cruising flight, with a transition between the two modes. At maximum cruising speed the stub wing provides about 60% of the total lift, the remainder being provided by the auto-rotating rotor.

After a necessarily long period of test and development work—including that on the tip-jet system; on a complete full-scale working rig of the rotor and power system; on the rotor control system; and in the wind tunnel—the Rotodyne began ground-resonance trials on October 25, 1957, and the first flight, using a helicopter technique only, was made on November 6, 1957.

After a series of carefully planned and analysed tests, the first transition from helicopter to Autogiro flight was achieved without loss of height on April 10, 1958. Since then—using comprehensive strain-gauge measurements for the rotor system and airframe—the propeller-driven cruising speed has been increased step by step to a value of 155 m.p.h. One of the problems to be solved before the Rotodyne can be accepted for city-centre operations is that of noise from the tip-jets; intensive research work since 1952 has resulted in a silencing nozzle which should reduce this noise to an acceptable level, particularly in the case of an aircraft with a rate of climb of 1,500 ft./min.

In its initially developed form the Rotodyne will cruise at 185 m.p.h. and will have a maximum range of 390 n.m.—or a typical sector range, carrying 48 passengers, of 170 n.m.

The Westland Wessex

WESTLAND AIRCRAFT, LTD., concluded licence agreements with Sikorsky covering the single-engined S-58 in 1956, and a demonstration model (a standard U.S. Navy HSS-1) was brought to England in that year. After completing some preliminary flying with the HSS-1 in this form, Westland set about converting the design to take the Napier Gazelle shaft turbine and flew the prototype with this engine for the first time on May 17, 1957.

Known as the Wessex, this Gazelle-powered helicopter has gone into production for the Royal Navy for use in the anti-submarine rôle, and Naval requirements will monopolize production deliveries from the end of 1958 onwards. A civil version of the Wessex will be

Commercial Aircraft . . . .

Photograph copyright "The Aeroplane"

The first production Westland Wessex, with Gazelle engine, made its first flight on June 20. A civil version will be available in due course.

offered in due course, however, and preliminary estimates for this version are shown in the accompanying table. This would carry 12 passengers or 2½ tons of freight and would have rather superior performance to the piston-engined S-58 from which it has been developed (see below and next page).

Structurally, the Wessex resembles the S-58, with a semi-monocoque fuselage and all-metal rotor blades. The usual provisions can be made for fitting a winch and floats or pontoons. The crew of two sit forward and above the main cabin, a freight hold being below the flight deck.

The Westland Westminster

LIKE the Wessex, the Westminster is a Westland modification of a basic Sikorsky design—in this case the twin-engined S-56. Westland interest in the S-56 was confirmed in 1955, and the type has since then been quite extensively redesigned to make use of two Eland shaft-drive turbines in place of the Pratt & Whitney radials. In fact, little of the S-56 now remains in outward appearance beyond the main and tail rotor systems.

Development of the Westminster falls into three stages, the first of which is the construction of two prototypes. The first of these flew on June 15 at Yeovil, and will be followed by a second, slightly modified "flying crane" test-bed. These are intended to prove the Eland powerplants and both have a tubular frame fuselage. The Westminster will also be available in this form as a general utility-cum-freighter-type in due course.

With the prototype trials complete, Westland will proceed with development of military and civil Westminsters—and preliminary estimates for the latter are tabulated here. Both these types will have a conventional monocoque fuselage structure in which it will be possible to accommodate up to 45 passengers, plus a flight crew of two and a cabin attendant. At the rear of the cabin is a freight hold. The Elands are mounted side-by-side above the forward fuselage, and drive the rotor through a rearward extension of the turbine shaft via a common gearbox. Fully duplicated power-operated controls are provided for both main and tail rotors.

WESTMINSTER

Dimensions
- Rotor diameter: 72 ft. 0. in.
- Overall length: 86 ft. 9 in.
- Overall height: 22 ft. 3 in.
- Gross disc area: 4,073.1 sq. ft.
- Internal cabin dimensions:
  - Length (ex. flight deck): 30 ft. 0 in.
  - Max. width: 126 in.
  - Max. height: 78 in.
  - Max. usable floor area (ex. flight deck): 315 sq. ft.
  - Max. usable volume (ex. flight deck): 2,048 cu. ft.

Accommodation
- Normal: 40–45 (5 abreast).

Powerplants
- Two Napier Eland N.El.6.
- Take-off power each (I.S.A., s.l.): 3,500 e.h.p. at 12,500 r.p.m.
- Five-blade all-metal main and four-blade all-metal tail rotor.

Weights and Loadings
- Basic operational: 21,845 lb.
- Total fuel: 7,640 lb.
- Mfrs. max. payload: 11,145 lb.
- Max. take-off: 35,200 lb.
- Disc loading (max. t-o. wt.): 8.6 lb./sq. ft.

Performance
- Recommended cont. cruising speed (I.S.A.): 130 knots (at sea level and 33,000 lb.); consumption: 0.707 lb./s.h.p./hr.; power (per engine): 2,500 e.h.p. at 12,000 r.p.m.
- Range (take-off to landing), still air, no reserves, I.S.A., max. fuel (950 Imp. gal.): 450 naut. mi. with 11,145 lb. payload at 130 knots (mean) at sea level.
- Range (take-off to landing), still air, no reserves, I.S.A., with max. payload: 450 naut. mi.

WESSEX

Dimensions
- Rotor diameter: 56 ft. 0 in.
- Overall length: 65 ft. 9 in.
- Overall height: 15 ft. 10 in.
- Gross disc area: 2,461 sq. ft.
- Internal cabin dimensions:
  - Length (ex. flight deck): 15 ft. 6 in.
  - Max. width: 56 in.
  - Max. height: 70 in.
  - Max. usable volume (ex. flight deck): 397 cu. ft.

Accommodation
- Normal: 12 (3 abreast).
- Volume of freight and baggage holds: 36 cu. ft.

Powerplants
- One Napier Gazelle N.Ga.13.
- Rated (1 hr.) power (I.S.A., s.l.): 1,430 s.h.p.
- Four-bladed all-metal main rotor and tail rotor.

Weights and Loadings
- Basic operational: 7,600 lb.
- Total fuel: 2,400 lb.
- Mfrs. max. payload: 2,260 lb.
- Max. take-off: 12,600 lb.
- Max. landing: 12,600 lb.
- Disc loading (max. t-o. wt.): 5.12 lb./sq. ft.

Performance
- Recommended cont. cruising speed (I.S.A.): 110 knots (at sea level and 12,600 lb.); consumption: 90 Imp. gal./hr.; power (per engine): 1,200 s.h.p.
- Range (take-off to landing), still air, no reserves, I.S.A., max. fuel (300 Imp. gal.): 340 naut. mi. with 2,260 lb. payload at 100 knots (mean) at sea level.
- Range (take-off to landing), still air, no reserves, I.S.A., with max. payload: 340 naut. mi.

Sikorsky S-58

OF the several types of Sikorsky helicopter available for commercial operations, the S-58 is the latest to be used for scheduled passenger carrying. The type originated as a military development of the S-55, and has been widely produced for the U.S.A.F., U.S. Army, U.S. Navy and Marines and for foreign

The prototype Westland Westminster on its first flight on June 15. This open-framework version is intended to prove the powerplant/rotor system.

Commercial Aircraft . . . .

A Sikorsky S-58 in service with Chicago Helicopter Airways.

services. Its general characteristics are shown in the accompanying tabulation.

The S-58 is in service in the U.S.A. with Chicago Helicopter Airways and until recently was used also by New York Airways; in Europe a fleet is operated by Sabena. Equipped for passenger service, the first cost is $248,000 plus the cost of any special equipment. Both Sabena and N.Y.A. found it necessary to fit flotation gear to allow for emergency landings on water, and this caused a serious loss of payload.

The basic S-58 design is in production in Britain as the Westland Wessex (which see) with a Napier Gazelle gas turbine. Sikorsky are also now developing a range of gas-turbine-powered helicopters for commercial or military use. These include the S-61, an S-58 derivative with a new fuselage and two small shaft-driven turbines side by side immediately beneath the rotor; this would accommodate 20-25 passengers. Another future development is a 40-passenger, four-turbine design based on the S-56.

In May, Sikorsky began flight trials with their S-62, a version of the smaller S-55 powered by a single 1,050 s.h.p. General Electric T58-GE-6 shaft turbine and provided with a boat-type hull in addition to wheels. With accommodation for 8-12 passengers, the S-62 weighs 7,500 lb. and has a performance broadly comparable to that of the S-58.

Vertol 44

THE Vertol 44 has gone into regular passenger service this year following its certification by the C.A.A. about a year ago. It is a version of the original Piasecki (now Vertol) H-21 Work Horse which has been in production for and service with the U.S.A.F. and U.S. Army for several years. Three versions of the Model 44 now offered are the 44A, military export; the 44B passenger transport; and 44C executive.

A fleet of Vertol 44Bs has been acquired by New York Airways to replace Sikorsky S-55s and S-58s, and these new aircraft went into service in May on the N.Y.A. network. They are arranged to carry 15 passengers in an airline-type interior which represents a considerable advance over previous helicopter layouts, and they also have flotation gear as an integral installation. A Vertol 44B is also being evaluated by Sabena.

The tabulated data apply to the basic 44B without the N.Y.A. flotation gear.

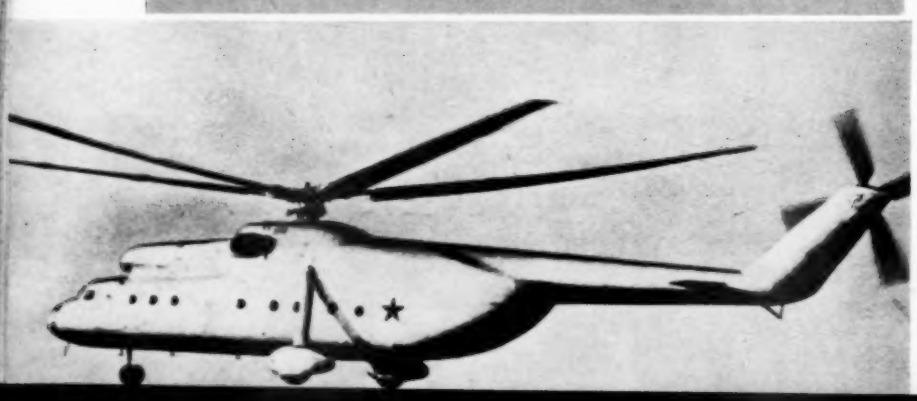
Soviet Helicopters

SEVERAL helicopters which, potentially at least, are suitable for passenger transportation, have been developed in Russia. Recent reports suggest that the Mil Mi-4 is now being used by Aeroflot, for passenger and freight services in the more remote areas and for short-haul operations around centres of population.

Powered by a 1,700 h.p. ASh-82V engine, the Mi-4 has a gross weight of 15,875 lb. and carries a normal payload of 2,645 lb. Performance in general is comparable to that of the Sikorsky S-58 and accommodation in the passenger-carrying Mi-4P is for 10 people.

Still in the early stages of development, the Mi-6 is the World's biggest helicopter, a fact which was proved on October 30, 1957, when a load of 26,463 lb. was lifted to a height of 7,979 ft., establishing records which have been confirmed by the F.A.I. The Mi-6 is powered by two 4,700 e.h.p. TB-2BM shaft turbines and is believed to be able to accommodate about 70 passengers.

The tandem-rotor Yak-24, powered by two 1,700 h.p. ASh-82V engines, has a 10,000 lb. payload and may also be used by Aeroflot, in addition to the Soviet Air Force.



Left above, a Vertol 44B with flotation gear, operating with New York Airways and, left, the Mil Mi-6, biggest helicopter in the World.

SIKORSKY S-58

Dimensions
Rotor diameter: 56 ft. 0 in.
Fuselage length: 46 ft. 9 in.
Overall height: 15 ft. 10 in.
Gross disc area: 2,461 sq. ft.
Internal cabin dimensions:
Length: 12 ft. 10 in.
Max. width: 60 in.
Max. height: 69 in.

Accommodation
Normal: 12 (3 abreast).
Max.: 16 (3 abreast).

Powerplants
One Wright Cyclone 989 C9HE-2
Take-off power each (I.S.A., s.l.): 1,525 b.h.p. at 2,800 r.p.m.

Weights and Loadings
Basic operational: 7,929 lb.
Total fuel: 1,728 lb.
Mfrs. max. payload: 5,000 lb.
Max. take-off: 13,000 lb.
Disc loading (max. t-o. wt.): 5.3 lb./sq. ft.
Power loading (max. t-o. wt.): 8.52 lb./b.h.p.

Performance
Recommended cont. cruising speed (I.S.A.): 85 knots (at s.l. and 12,000 lb.); power: 855 b.h.p., consumption 73 Imp. gal./hr.
Range (take-off to landing), still air, no reserves, I.S.A., max. fuel (240 Imp. gal.): 300 naut. mi. with 3,150 lb. payload at 85 knots (mean) at s.l.

VERTOL 44B

Dimensions
Rotor diameter (each): 44 ft. 0 in.
Fuselage length: 52 ft. 6 in.
Overall height: 15 ft. 5 in.
Internal cabin dimensions:
Length (ex. flight deck): 20 ft. 0 in.
Max. width: 68 in.
Max. height: 66 in.
Max. usable volume (ex. flight deck): 600 cu. ft.

Accommodation
Normal: 15 (2 abreast).
Max.: 19 (— abreast).
Volume of freight and baggage holds: 50 cu. ft.

Powerplants
One Wright Cyclone 977C9HD1.
Take-off power each (I.S.A., s.l.): 1,425 b.h.p. at 2,700 r.p.m.

Weights and Loadings
Total fuel: 1,800 lb.
Max. take-off: 14,350 lb.
Wing loading (max. t-o. wt.): 4.72 lb./sq. ft.
Power loading (max. t-o. wt.): 10.0 lb./b.h.p.

Performance
Recommended cont. cruising speed (I.S.A.): 98 knots (at s.l. and 13,500 lb.); consumption: 70 Imp. gal./hr.
Range (take-off to landing), still air, no reserves, I.S.A., max. fuel (300 Imp. gal.): 310 naut. mi.

Piston-engined Transport Data

Dimensional and Weight Information

Aircraft	Dimensions									Accommodation				Weights						Loadings		
	Span	Length O.A.	Height O.A.	Gross wing area	Internal cabin					First-class	Tourist	Coach	Total freight hold volume†	Basic op.	Total fuel	Mfrs. max. payload	Max. take-off	Max. landing	Max. zero fuel	Wing loading (t.-o. wt.)	Wing loading (land wt.)	Power loading
					Length*	Max. height	Max. width	Floor area*	Usable volume													
	ft. in.	ft. in.	ft. in.	sq. ft.	ft. in.	in.	in.	sq. ft.	cu. ft.				cu. ft.	lb.	lb.	lb.	lb.	lb.	lb.	lb./sq. ft.	lb./sq. ft.	lb./b.h.p.
Airspeed Elizabethan ..	115 0	82 0	18 3	1,200	35 3	84	120	290	2,200	47	49	60‡	300	39,720	7,000	12,250	55,000	52,000	52,000	45.8	43.3	10.5
Boeing Stratocruiser ..	141 3	110 4	38 3	1,720	78 6	86	123	500	3,500	40	81	—	845	83,000	45,800	27,100	145,800	129,000	113,900	88.0	75.0	10.4
Breguet 765 Deux Ponts ..	140 0	95 0	32 0	2,009	54 6	204//	108	765	5,654	—	106	135	—	65,350	31,000	38,250	114,600	108,000	103,600	57.0	54.0	11.5
Bristol 170/31	108 0	68 4	28 3½	1,487	31 8	79.5	96	252	2,360	32	40	44	343	27,358	8,438	13,830	44,000	44,000	41,640	29.6	29.6	11.0
C.A.S.A. 202	70 10	52 6	19 11	618	24 0	73.3	68.5	120	667	—	14	—	101	12,035	3,400	2,840	18,080	17,090	14,875	27.7	26.2	11.8
Canadair Argonaut.. ..	117 6	93 7½	27 6½	1,463	42 6	84	119	—	—	40	56	—	269	51,500	26,100	15,700	82,000	72,000	68,000	56.0	49.0	11.6
Convair 340	105 4	79 2	28 2	920	57 4	78	108	—	—	44	—	—	—	30,986	10,500	14,140	47,000	46,500	45,000	51.1	50.5	9.82
Convair 440	105 4	79 2	28 2	920	57 4	78	108	283	1,817	44	52	—	514	33,440	10,380	11,655	49,100	47,650	45,000	53.4	48.9	9.82
D.H. Heron	71 6	48 6	15 7	499	23 0	69	54	89	515	14	17	—	127	8,996	2,966	3,750	13,500	13,150	12,670	27.1	26.4	13.5
Douglas DC-3	95 0	64 5½	16 11	987	22 9	69	84	170	1,040	30	32	—	123	19,730	4,760	7,173	28,000	26,900	26,900	28.3	27.2	11.65
Douglas DC-4	117 6	93 5	27 7	1,457	60 0	92	95	470	—	—	—	—	266	45,950	21,552	16,370	73,000	63,500	60,700	50.1	43.6	12.6
Douglas DC-6A	117 6	105 7	28 8	1,463	70 0	—	—	—	—	—	—	—	5,000	56,400	—	30,140	107,000	88,200	83,200	73.1	60.4	10.7
Douglas DC-6B	117 6	105 7	28 8	1,463	70 0	—	—	—	—	—	—	—	509	63,382	—	21,043	102,800	85,000	81,340	68.4	58.2	10.4
Douglas DC-7C	127 6	112 3	31 10	1,637	74 3	83	118.5	—	—	62	89	105	954	78,890	46,944	22,434	143,000	109,000	101,500	87.3	66.7	10.5
Hunting President	64 6	46 0	16 0	400	20 0	72	66	—	—	—	12	—	50	9,136	1,670	3,800	13,500	13,500	—	33.7	33.7	12.7
Lockheed L-749A	123 0	95 3	23 1	1,650	39 4	79	120	—	3,000	40	60	—	434	68,640	34,934	16,300§	107,000	89,500	86,464	64.8	54.3	10.7
Lockheed L-1049G	123 5	116 2	24 9	1,650	—	—	121	744	—	47	94	—	728	82,500	—	21,700	137,500	113,000	103,500	83.3	68.5	10.5
Lockheed L-1049H	123 5	116 2	24 9	1,650	—	—	121	744	5,500	—	—	105	—	75,470	—	34,623	137,500	113,000	104,200	83.3	68.5	10.5
Lockheed L-1649A	150 0	116 1½	23 4½	1,850	83 1½	78	128.5	—	—	58	80	99	—	91,645	56,600	24,355	156,000	123,000	116,000	84.3	66.5	11.5
Vickers Viking 1B	89 3	62 10	19 6	882	39 3	80	95	249	1,665	24	27	—	250	24,000	5,400	7,120	34,000	33,250	—	38.0	37.0	10.0

* Excluding flight deck. † Outside cabin area. ‡ Theoretical. § B.O.A.C. tourist. // Two decks.

Power and Performance Summary

Aircraft	Power plant				Performance														
	No.	Type	T.O. Power (each)		Recommended cont. cruise					Approach speed	Balanced field length†			Landing distance	Range (take-off to landing) no reserves					
					Speed	Alt.	Weight	Consumption	Power per engine		I.S.A., s.l.	I.S.A.+15°C. s.l.	I.S.A. 5,000 ft.		Max. fuel					Max. Payload
															Range	Payload	Speed	Alt.	Fuel	
			b.h.p.	r.p.m.	knots	ft.	lb.	Imp. gal./hr.	b.h.p.	knots	ft.	ft.	ft.	ft.	naut.mi.	lb.	knots	ft.	Imp. gal.	naut. mi.
Airspeed Elizabethan	2	Centaurus 661	2,625	2,700	209	15,000	49,500	150	1,200	105	6,050	6,860	6,560*	4,350	1,266	8,290	194	15,000	986	504
Boeing Stratocruiser	4	R-4360-B6	3,500	2,700	232	14,000	130,000	420	1,750	123	7,100	8,050	—	4,050	3,575	9,000	226	14,000	6,430	2,460
Breguet 765 Deux Ponts	4	R-2800-CB-17	2,500	2,800	190	10,000	110,000	300	1,150	120	5,500	6,250	7,500	2,600	3,000	17,870	190	10,000	4,220	900
Bristol 170/31	2	Hercules 734	2,000	2,800	137	S.L.	44,000	110	1,000	94	2,600	3,100	4,100	2,280	1,400	8,204	137	S.L.	1,172	—
C.A.S.A. 202	2	Beta B.IV	775	2,200	178	9,850	18,080	83	550	88	—	—	—	2,560	945	2,645	178	9,850	470	885
Canadair Argonaut	4	Merlin 724	1,760	3,000	211	16,000	69,000	224	950	104	5,800	—	—	2,960	3,040	4,400	214	16,000	3,226	2,030
Convair 340	2	R-2800-CB-16	2,400	2,800	240	20,000	44,000	170	1,200	—	4,650	4,850	6,750	2,380	1,095§	8,580	246	20,000	1,440	—
Convair 440	2	R-2800-CB-17	2,500	2,800	250	20,000	45,000	175	1,200	—	5,000	—	—	4,010	1,590	8,580	—	20,000	1,440	840
D.H. Heron	4	Gipsy Queen 30 Mk.2	250	2,500	159	8,000	13,000	42	165	81	3,570	3,870	5,150	2,065	1,540	1,320	159	8,000	412	500
Douglas DC-3	2	R-1830-92	1,200	2,700	144	6,000	27,000	68	550	90	3,645	4,050	4,110‡	2,155	1,388	3,513	140	6,000	670	493
Douglas DC-4	4	R-2000-SD13G	1,450	2,700	200	10,000	60,000	—	720	108.5	5,050	—	—	2,760	3,690	8,707	203	10,000	2,991	1,800
Douglas DC-6A	4	R-2800-CB-17	2,500	2,800	243	—	—	—	1,200	123	6,150	—	—	—	—	17,580	—	—	4,580	3,540
Douglas DC-6B	4	R-2800-CB-16	2,400	2,800	243	15,000	—	—	1,200	121	5,725	—	—	—	—	14,214	—	—	4,580	—
Douglas DC-7C	4	Turbo-Compound EA-1	3,400	2,900	300	21,600	110,000	422	1,800	—	6,360	—	—	5,100	4,890	15,310	238	15,000	6,515	4,025
Hunting President	2	Leonides 504/5A	540	3,000	143	8,000	13,000	30	245	—	3,800	—	—	2,525	1,010	2,500	143	8,000	238	933
Lockheed L-749A	4	R-3350-C18-BD1	2,500	2,800	230	13,000	94,000	306	1,200	105	4,840	5,095	6,900	2,890	3,580	3,500	230	13,000	4,350	2,190
Lockheed L-1049G	4	R-3350-C18-DA-3	3,250	2,900	290	22,600	113,000	—	1,810	114	5,030	—	—	3,490	4,185	8,550	—	10,000	6,453	—
Lockheed L-1049H	4	R-3350-C18-DA-3	3,250	2,900	290	22,600	113,000	—	—	114	5,030	—	—	3,490	4,185	15,576	—	10,000	6,453	—
Lockheed L-1649A	4	Turbo-Compound EA-2	3,400	2,900	297	22,600	123,000	417	1,800	—	6,500	—	—	3,600	6,365	7,755	222	15,000	7,993	4,900
Vickers Viking 1B	2	Hercules 634	1,675	2,800	182	10,000	32,500	88	720	—	3,600	4,200	4,350	3,650	1,950	4,600	149	10,000	750	1,000

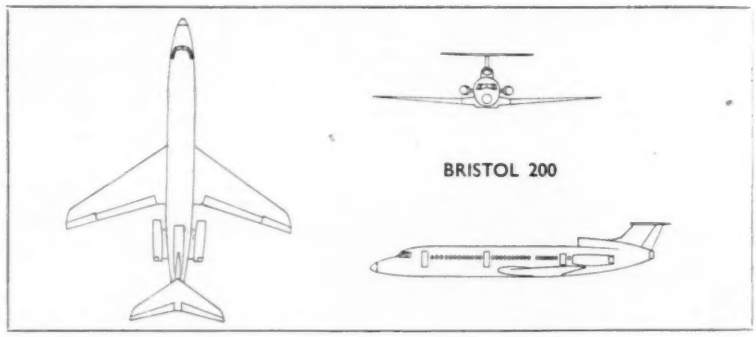
* I.S.A. at 2,000 ft. † at max. take-off weight. ‡ I.S.A. at 3,000 ft. § with 1,500 lb. reserve fuel.

Projects and Proposals

Blackburn B.107

UNDER this designation, Blackburn and General Aircraft have had a design study for a large pressurized turboprop freighter under consideration for about two years. Aimed primarily at the military market as a Beverley replacement, the B.107 would have obvious commercial interest if produced. The company has revealed no details of the project other than the fact that it would follow the layout of the Beverley, with the same wing, four Tyne Stage II engines, a retractable undercarriage, pressurized fuselage and nose-loading doors in addition to the rear fuselage ramp.

With a gross weight of about 170,000 lb., the B.107 would have a maximum payload of 53,000 lb. over stages of 1,300 naut. miles, and 38,500 lb. over 2,500 naut. miles. Cruising speed would be 325 knots at 22,000 ft.



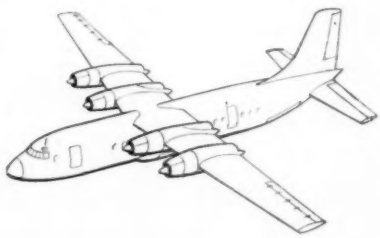
Bristol 200

ORIGINALLY one of the short-haul turbojet contestants for the B.E.A. order, the Bristol 200 has since been discussed with U.S. operators as a project sponsored by a Bristol/Hawker Siddeley joint company. The general arrangement drawing reproduced here is that of the original concept and does not necessarily represent, except in its overall layout, the aircraft which may be produced as a result of American and other airline interest. No decision has yet been reached as to whether the 200 will come into active existence.

In its original form (as described in January this year) the following figures were given for the 200:—Span, 91 ft.; length, 121 ft. 6 in.; max. gross weight, 120,000 lb.; speed, 520 knots (plus); capacity payload, 21,000 lb.; stage distance with capacity payload, 1,475 naut. miles. No information was given about the powerplants (a group of three at the rear of the fuselage), but it was assumed that these might be Rolls-Royce R.B.141s or Curtiss-Wright Zephyrs (U.S. derivations of the Olympus).

Short PD.18 Britannic

THE Short PD.18 is a design study submitted by Short Brothers and Harland, Ltd., to the Ministry of Supply for a new turboprop heavy freighter utilizing Bristol Britannia components. The project has been designed primarily for transport of heavy military freight, but Shorts have also examined its performance as a civil freight/passenger transport.



The PD.18 (known by its sponsors as the Britannic) is virtually a Bristol Britannia with a new fuselage half as big again. In its initial form it is designed around four uprated Bristol Proteus engines, but in advanced versions would use a more powerful engine such as the Rolls-Royce Tyne. Standard Britannia powerplant, fuel system, controls, flight-deck installations, undercarriage and tail unit are used. The wing also is largely standard, but would be mounted high on the fuselage and would need minor modification to cope with higher landing weights. The undercarriage would retract into fuselage fairings.

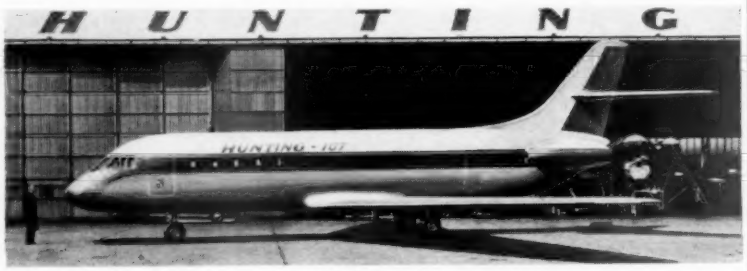
The new fuselage is fitted with a low-level floor and has parachuting facilities and a large rear loading ramp. Volume and cross-section are greater than in the Britannia and the overall dimensions of the freight hold are 80 ft. by 12 ft. by 12 ft.

Initially the PD.18 would have approximately the same take-off weight as the Britannia 310 series (180,000 lb.), but this could be increased to over 200,000 lb. The aircraft would carry a payload of about 30

Hunting H-107

HUNTING AIRCRAFT have been studying the possibilities of a small, twin-engined short-haul turbojet transport under the designation H-107 for the past two years or so. In that time the design has evolved considerably and has now reached the point where a mock-up is nearly complete, initial wind-tunnel tests have been finished and detail design could begin when the company thinks the time is right.

Detailed specifications for the H-107, to the same standards as the data appearing elsewhere in this issue, appear below, and have not been previously published. The rated power of the civil Orpheus 810 using water injection is 5,200 lb. in I.S.A. at sea level, but water would normally be used only to restore power lost at high temperatures and altitudes. The H-107 has a CL max. of 2.24.



Dimensions
- Span: 80 ft. 0 in.
- Overall length: 77 ft. 9 in.
- Overall height: 24 ft. 0 in.
- Gross wing area: 800 sq. ft.
- Sweepback: 20° at 25% M.A.C.
- Internal cabin dimensions:
  - Length (ex. flight deck): 49 ft. 0 in.
  - Max. width: 102 in.
  - Max. height: 74.5 in.
  - Max. usable floor area (ex. flight deck): 360 sq. ft.
  - Max. usable volume (ex. flight deck): 1,000 cu. ft.

Accommodation
- Normal first-class: 40.
- Normal tourist: 44
- Max. coach: 48.
- Volume of freight and baggage holds: 163 cu. ft. in two holds.

Powerplants
- Two Bristol Orpheus 810.
- Take-off power each (I.S.A., s.l.): 4,850 lb.s.t.
- Water injection system installed. Provision for silencers and reversers.

Weights and Loadings
- Basic operational: 20,670 lb.
- Total fuel: 17,840 lb.
- Mfrs. max. payload: 10,960 lb.
- Max. take-off: 41,500 lb.
- Max. landing: 39,500 lb.
- Max. zero fuel: 31,630 lb.
- Wing loading (max. t-o. wt.): 51.9 lb./sq. ft.
- Wing loading (max. landing wt.): 49.4 lb./sq. ft.
- Power loading (max. t-o. wt.): 4.28 lb. s.t.

Design Criteria
- Design limits: Mc/Vc=.75 (270k) Mne/Vne=.75 (270k) Md/Vd=.85 (340k).

Performance
- Recommended cont. cruising speed (I.S.A.): 400 knots (at 36,000 ft. and 34,000 lb.); consumption: 455 Imp. gal./hr.; power (per engine): 93.5% max. r.p.m.
- Approach speed (at max. landing wt.): 105 knots.
- Balanced field lengths (at max. t-o. wt.): At I.S.A. at sea level: 4,800 ft. At I.S.A.+15°C. at sea level: 5,400 ft. At I.S.A. at 5,000 ft.: 6,700 ft.
- Landing distance from 50 ft. (unfactored, max. landing wt.): 2,950 ft.
- Range (take-off to landing), still air, no reserves, I.S.A., max. fuel (2,230 Imp. gal.): 2,000 naut. mi. with 3,600 lb. payload at 390 knots (mean) at 41,500 ft. (mean).
- Range (take-off to landing), still air, no reserves I.S.A., with max. payload: 950 naut. mi.

tons over a range of 900 naut. miles, and it should be possible to increase this to 50 tons over the same distance. The useful range of the aeroplane could be extended to about 2,600 naut. miles and the optimum cruising speed would be 300-350 knots.

C.A.C. Project

THE Commonwealth Aircraft Corporation in Melbourne are reported to have drawn up proposals for a twin-engined 12-15-passenger transport suitable for use as a DC-3 replacement in Australia. The project, which has been submitted to the Australian Government, is intended to keep C.A.C. at work after production of the Avon-Sabre terminates in 1961.

Douglas DC-9

DOUGLAS have, since 1951, been actively considering a medium-range jet transport with the designation DC-9. Basically, the design has been approached as a small-scale DC-8, with about half the wing area and two-thirds the range, and the same four-podded engine arrangement. In the course of studies, many other layouts have been considered, including two- and three-engined arrangements and rear-engined designs, but the DC-8-type layout is still most favoured. At the present time, Douglas envisage using four 7,500-lb. Pratt & Whitney JT-8 (J52) turbojets, but the final choice of engine still depends on timing and customer preference.

Discussions with prospective customers are continuing and now that the engineering peak on to DC-8 has been passed, an intensification of the campaign to sell this smaller project can be expected.

Frye F.1 and F.2

THE Frye F.1 Safari project for a rugged, cheap freighter/coach has now been extant for nearly three years. In that time it has aroused a good deal of interest from operators, but the Frye Corporation has to date been unable to finance its construction. The intention was to have this four-engined "DC-3 replacement" built by an established aircraft manufacturer in the U.S.A. or Europe.

The F.1 would have four 800-b.h.p. Cyclone 9BA1 piston engines and would accommodate 56-75 passengers or up to 12,000 lb. of freight. Basic data are: Span, 109 ft. 6 in.; length, 79 ft. 6 in.; max. payload, 19,821 lb.; gross weight, 45,000 lb.; cruising speed, 157 knots; balanced field length, 3,200 ft.; and range with max. fuel (no reserves), 1,600 naut. miles.

As a refinement of the F.1, Frye Corporation have also projected the F.2, having the same general layout but powered by two Rolls-Royce Dart R.Da.7/2 turboprops. The fuselage is lengthened by 10 ft. to accommodate 65-79 passengers and is moderately pressurized. Data include: gross weight, 50,000 lb.; max. payload up to 25,000 lb.; cruising speed 205 knots at 10,000 ft.; range with max. fuel (45-min. reserve), 1,615 naut. miles.

Hayden Stout Bushmaster

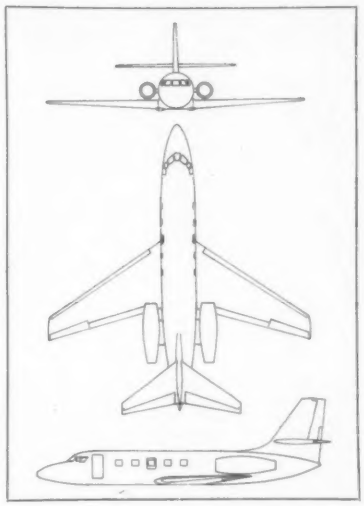
HAYDEN AIRCRAFT CORP., of Gardena, California, is undertaking the modernization of the Ford Tri-Motor with a view to its production to current airworthiness standard. The company believes that the basic design is still suitable for "dirty, rugged, day-to-day operation in rough, undeveloped country where maintenance facilities and modern flying aids are unheard of."

Design and engineering changes are being proved out on an original Tri-Motor which the company has acquired, and manufacture has begun on three new aircraft. The first of these is expected to be flying by the end of 1958. Manufacturing and financial support for the project—which is to be known as the Stout Bushmaster—is being given by Aircraft Hydro-Forming, Inc.

Lockheed 329 Jetstar

LOCKHEED have built two prototypes of their Jetstar to meet a U.S.A.F. requirement for a utility transport and pilot-readiness trainer and have announced that this aircraft will be offered for commercial executive use if it is put into production for the military. Already a great deal of interest has been aroused and production-line positions on 40 or so aircraft are reported to have been reserved by prospective customers.

The standard Jetstar will accommodate 10 passengers and a crew of two; the cabin is 28 ft. long and has a capacity, excluding the flight deck, of about 750 cu. ft. Both proto-



types are powered by two Bristol Orpheus B.Or.1/5 turbojets, the production form of which would be the Curtiss-Wright TJ37. Lockheed also offer the Jetstar with four General Electric J85 engines, but have still to fly this variant.

If a production decision was reached now by the U.S.A.F., commercial Jetstars could be available in 1959. Production will be handled at the Marietta, Georgia, factory, although the two prototypes were built at Burbank where the first flew on September 4, 1957. Provision is made for long-range slipper tanks on the wings and, with these fitted, the Jetstar has flown 2,700 naut. miles without refuelling.

Direct operating cost of the Jetstar has been estimated, using modified A.T.A. method and assuming 600 hr. utilization and 1,500 naut. mile stage-length, at 26.4 U.S. cents per aircraft-mile.

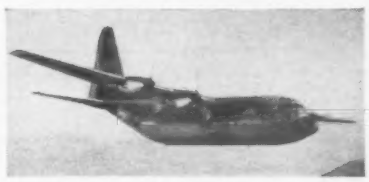
Some basic data for the twin-Orpheus version follow: Span, 53 ft. 8 in.; gross wing area, 523 sq. ft.; overall length, 58 ft. 10 in.; basic operational weight, 15,139 lb.; max. payload, 4,000 lb.; normal gross weight 29,333 lb.; max. zero fuel weight, 18,333 lb.; max. gross weight (1,066 Imp. gallons in slipper tanks), 38,841 lb.; max. landing weight, 26,000 lb.; optimum cruising speed, 442 knots T.A.S. at 15,000 ft.; max. range with internal fuel (1,970 Imp. gal.) inc. 30 min. reserve and 5% tolerance, 1,500 naut. miles; max. range with max. fuel, 2,500 naut. miles.

Lockheed 282A Hercules

DETAILED studies have been made by Lockheed of the commercial application of their C-130 Hercules military freighter, and the company is now in a position to offer this type for civil use in 1960. The project is based upon the newest C-130B variant with greater gross weight and more powerful engines; commercial design studies have been made for weights up to 150,000 lb. The engines would be Allison 501D-22s, equivalent to the military T56-A-7A rated at 4,050 e.h.p. for take-off.

The Hercules has a cabin volume of 4,300 cu. ft. measuring 41 ft. by 10 ft. by 9 ft. Provision is made for rear loading. Brief data follow:

Span, 132 ft. 7 in.; length, 97 ft. 8 in.; operating weight, empty, 69,300 lb., max. payload, 47,400 lb.; gross weight, 135,000 lb.; landing weight, 121,600 lb.; max. zero fuel weight, 114,600 lb.; cruising speed, 282



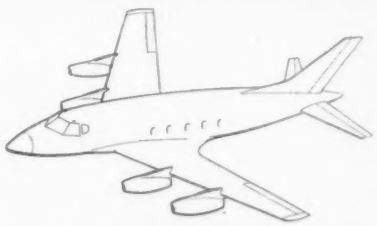
knots at 80% power; range with max. fuel (5,745 Imp. gal.), 2,700 naut. miles with 36,500 lb. payload; range with max. payload (including 7,000 lb. fuel reserve), 1,860 naut. miles.

McDonnel 119

McDONNEL AIRCRAFT are constructing a prototype of their Model 119 utility jet transport to compete with the Lockheed Jetstar for a U.S.A.F. contract. If put into production, the 119 would also be available for executive and feeder-line use. The layout is orthodox by U.S. standards, with a low wing and four podded engines—either General Electric J85 or Fairchild J83, both rated at 2,000 lb.s.t. for take-off.

In the 685-cu.-ft. cabin, the 119 would normally seat 10 passengers, with up to 17 in high-density arrangements, or 9,000 lb. of freight. Normal fuel capacity in integral wing tanks is 1,300 Imp. gal., with provision for 510 gal. in a centre-section tank and up to 915 gal. externally under the fuselage.

Preliminary data for the McDonnel 119

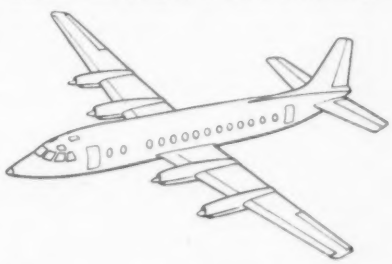


with J85s are as follow: Span, 57 ft.; wing area, 550 sq. ft.; length, 66 ft.; gross weight, 33,750 lb.; range with normal fuel (30 min. reserve), 1,500 naut. miles; range with max. fuel (30 min. reserve), 2,200 naut. miles; cruising speed Mach=.73-.79.

Republic Rainbow

REPUBLIC AVIATION have been conducting market research since the end of 1957 into transport aircraft in the medium-range category. A questionnaire has been circulated widely in the airline industry and this included details of an aircraft called the Rainbow as a basis to be used in answering the questions.

Although more than a pencil sketch, the Rainbow is not at present a serious design study and if Republic proceed with an aircraft in this category it would presumably



include changes in the light of the survey. As presented to the airlines the Rainbow was a four-engined 77,500-lb. gross weight design, with maximum accommodation for 80 passengers and powered by four 2,600 e.h.p. Dart R.Da.10s or General Electric T64s. Emphasis was placed upon good field performance, using leading-edge slats; balanced take-off distance required at max. weight would be 3,160 ft. (I.S.A. at sea-level) and C.A.R. landing field length at 74,000 lb. would be 4,000 ft.

Projects and Proposals

Blackburn B.107

UNDER this designation, Blackburn and General Aircraft have had a design study for a large pressurized turboprop freighter under consideration for about two years. Aimed primarily at the military market as a Beverley replacement, the B.107 would have obvious commercial interest if produced. The company has revealed no details of the project other than the fact that it would follow the layout of the Beverley, with the same wing, four Tyne Stage II engines, a retractable undercarriage, pressurized fuselage and nose-loading doors in addition to the rear fuselage ramp.

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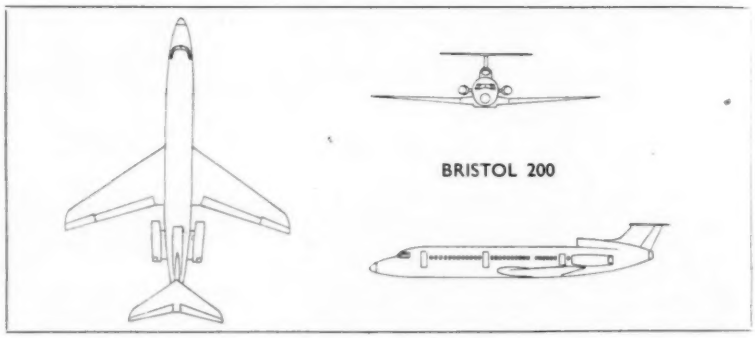


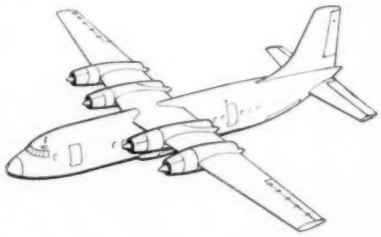
Bristol 200

ORIGINALLY one of the short-haul turbojet contestants for the B.E.A. order, the Bristol 200 has since been discussed with U.S. operators as a project sponsored by a Bristol/Hawker Siddeley joint company. The general arrangement drawing reproduced here is that of the original concept and does not necessarily represent, except in its overall layout, the aircraft which may be produced as a result of American and other airline interest. No decision has yet been reached as to whether the 200 will come into active existence.

In its original form (as described in January this year) the following figures were given for the 200:—Span, 91 ft.; length, 121 ft. 6 in.; max. gross weight, 120,000 lb.; speed, 520 knots (plus); capacity payload, 21,000 lb.; stage distance with capacity payload, 1,475 naut. miles. No information was given about the powerplants (a group of three at the rear of the fuselage), but it was assumed that these might be Rolls-Royce R.B.141s or Curtiss-Wright Zephyrs (U.S. derivations of the Olympus).

Short PD.18 Britannic

THE Short PD.18 is a design study submitted by Short Brothers and Harland, Ltd., to the Ministry of Supply for a new turboprop heavy freighter utilizing Bristol Britannia components. The project has been designed primarily for transport of heavy military freight, but Shorts have also examined its performance as a civil freight/passenger transport.



The PD.18 (known by its sponsors as the Britannic) is virtually a Bristol Britannia with a new fuselage half as big again. In its initial form it is designed around four uprated Bristol Proteus engines, but in advanced versions would use a more powerful engine such as the Rolls-Royce Tyne. Standard Britannia powerplant, fuel system, controls, flight-deck installations, undercarriage and tail unit are used. The wing also is largely standard, but would be mounted high on the fuselage and would need minor modification to cope with higher landing weights. The undercarriage would retract into fuselage fairings.

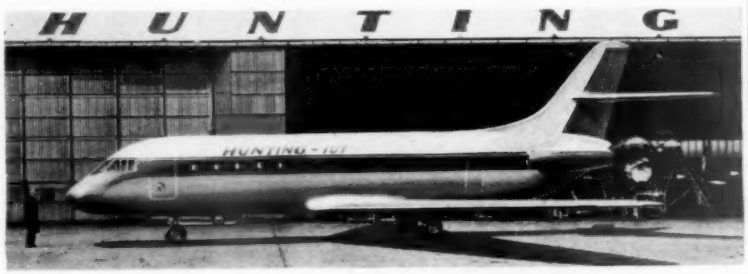
The new fuselage is fitted with a low-level floor and has parachuting facilities and a large rear loading ramp. Volume and cross-section are greater than in the Britannia and the overall dimensions of the freight hold are 80 ft. by 12 ft. by 12 ft.

Initially the PD.18 would have approximately the same take-off weight as the Britannia 310 series (180,000 lb.), but this could be increased to over 200,000 lb. The aircraft would carry a payload of about 30

Hunting H-107

HUNTING AIRCRAFT have been studying the possibilities of a small, twin-engined short-haul turbojet transport under the designation H-107 for the past two years or so. In that time the design has evolved considerably and has now reached the point where a mock-up is nearly complete, initial wind-tunnel tests have been finished and detail design could begin when the company thinks the time is right.

Detailed specifications for the H-107, to the same standards as the data appearing elsewhere in this issue, appear below, and have not been previously published. The rated power of the civil Orpheus 810 using water injection is 5,200 lb. in I.S.A. at sea level, but water would normally be used only to restore power lost at high temperatures and altitudes. The H-107 has a CL max. of 2.24.



Dimensions
- Span: 80 ft. 0 in.
- Overall length: 77 ft. 9 in.
- Overall height: 24 ft. 0 in.
- Gross wing area: 800 sq. ft.
- Sweepback: 20° at 25% M.A.C.
- Internal cabin dimensions:
  - Length (ex. flight deck): 49 ft. 0 in.
  - Max. width: 102 in.
  - Max. height: 74.5 in.
  - Max. usable floor area (ex. flight deck): 360 sq. ft.
  - Max. usable volume (ex. flight deck): 1,000 cu. ft.

Accommodation
- Normal first-class: 40.
- Normal tourist: 44
- Max. coach: 48.
- Volume of freight and baggage holds: 163 cu. ft. in two holds.

Powerplants
- Two Bristol Orpheus 810.
- Take-off power each (I.S.A., s.l.): 4,850 lb.s.t.
- Water injection system installed. Provision for silencers and reversers.

Weights and Loadings
- Basic operational: 20,670 lb.
- Total fuel: 17,840 lb.
- Mfrs. max. payload: 10,960 lb.
- Max. take-off: 41,500 lb.
- Max. landing: 39,500 lb.
- Max. zero fuel: 31,630 lb.
- Wing loading (max. t-o. wt.): 51.9 lb./sq. ft.
- Wing loading (max. landing wt.): 49.4 lb./sq. ft.
- Power loading (max. t-o. wt.): 4.28 lb. s.t.

Design Criteria
- Design limits: Mc/Vc=.75 (270k) Mne/Vne=.75 (270k) Md/Vd=.85 (340k).

Performance
- Recommended cont. cruising speed (I.S.A.): 400 knots (at 36,000 ft. and 34,000 lb.); consumption: 455 Imp. gal./hr.; power (per engine): 93.5% max. r.p.m.
- Approach speed (at max. landing wt.): 105 knots.
- Balanced field lengths (at max. t-o. wt.): At I.S.A. at sea level: 4,800 ft. At I.S.A.+15°C. at sea level: 5,400 ft. At I.S.A. at 5,000 ft.: 6,700 ft.
- Landing distance from 50 ft. (unfactored, max. landing wt.): 2,950 ft.
- Range (take-off to landing), still air, no reserves, I.S.A., max. fuel (2,230 Imp. gal.): 2,000 naut. mi. with 3,600 lb. payload at 390 knots (mean) at 41,500 ft. (mean).
- Range (take-off to landing), still air, no reserves, I.S.A., with max. payload: 950 naut. mi.

tons over a range of 900 naut. miles, and it should be possible to increase this to 50 tons over the same distance. The useful range of the aeroplane could be extended to about 2,600 naut. miles and the optimum cruising speed would be 300-350 knots.

C.A.C. Project

THE Commonwealth Aircraft Corporation in Melbourne are reported to have drawn up proposals for a twin-engined 12-15-passenger transport suitable for use as a DC-3 replacement in Australia. The project, which has been submitted to the Australian Government, is intended to keep C.A.C. at work after production of the Avon-Sabre terminates in 1961.

Douglas DC-9

DOUGLAS have, since 1951, been actively considering a medium-range jet transport with the designation DC-9. Basically, the design has been approached as a small-scale DC-8, with about half the wing area and two-thirds the range, and the same four-podded engine arrangement. In the course of studies, many other layouts have been considered, including two- and three-engined arrangements and rear-engined designs, but the DC-8-type layout is still most favoured. At the present time, Douglas envisage using four 7,500-lb. Pratt & Whitney JT-8 (J52) turbojets, but the final choice of engine still depends on timing and customer preference.

Discussions with prospective customers are continuing and now that the engineering peak on to DC-8 has been passed, an intensification of the campaign to sell this smaller project can be expected.

Frye F.1 and F.2

THE Frye F.1 Safari project for a rugged, cheap freighter/coach has now been extant for nearly three years. In that time it has aroused a good deal of interest from operators, but the Frye Corporation has to date been unable to finance its construction. The intention was to have this four-engined "DC-3 replacement" built by an established aircraft manufacturer in the U.S.A. or Europe.

The F.1 would have four 800-b.h.p. Cyclone 9BA1 piston engines and would accommodate 56-75 passengers or up to 12,000 lb. of freight. Basic data are: Span, 109 ft. 6 in.; length, 79 ft. 6 in.; max. payload, 19,821 lb.; gross weight, 45,000 lb.; cruising speed, 157 knots; balanced field length, 3,200 ft.; and range with max. fuel (no reserves), 1,600 naut. miles.

As a refinement of the F.1, Frye Corporation have also projected the F.2, having the same general layout but powered by two Rolls-Royce Dart R.Da.7/2 turboprops. The fuselage is lengthened by 10 ft. to accommodate 65-79 passengers and is moderately pressurized. Data include: gross weight, 50,000 lb.; max. payload up to 25,000 lb.; cruising speed 205 knots at 10,000 ft.; range with max. fuel (45-min. reserve), 1,615 naut. miles.

Hayden Stout Bushmaster

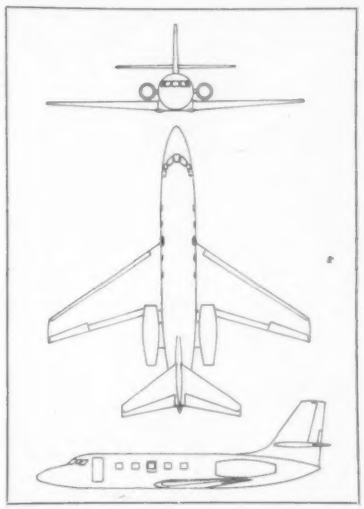
HAYDEN AIRCRAFT CORP., of Gardena, California, is undertaking the modernization of the Ford Tri-Motor with a view to its production to current airworthiness standard. The company believes that the basic design is still suitable for "dirty, rugged, day-to-day operation in rough, undeveloped country where maintenance facilities and modern flying aids are unheard of."

Design and engineering changes are being proved out on an original Tri-Motor which the company has acquired, and manufacture has begun on three new aircraft. The first of these is expected to be flying by the end of 1958. Manufacturing and financial support for the project—which is to be known as the Stout Bushmaster—is being given by Aircraft Hydro-Forming, Inc.

Lockheed 329 Jetstar

LOCKHEED have built two prototypes of their Jetstar to meet a U.S.A.F. requirement for a utility transport and pilot-readiness trainer and have announced that this aircraft will be offered for commercial executive use if it is put into production for the military. Already a great deal of interest has been aroused and production-line positions on 40 or so aircraft are reported to have been reserved by prospective customers.

The standard Jetstar will accommodate 10 passengers and a crew of two; the cabin is 28 ft. long and has a capacity, excluding the flight deck, of about 750 cu. ft. Both proto-



types are powered by two Bristol Orpheus B.Or.1/5 turbojets, the production form of which would be the Curtiss-Wright TJ37. Lockheed also offer the Jetstar with four General Electric J85 engines, but have still to fly this variant.

If a production decision was reached now by the U.S.A.F., commercial Jetstars could be available in 1959. Production will be handled at the Marietta, Georgia, factory, although the two prototypes were built at Burbank where the first flew on September 4, 1957. Provision is made for long-range slipper tanks on the wings and, with these fitted, the Jetstar has flown 2,700 naut. miles without refuelling.

Direct operating cost of the Jetstar has been estimated, using modified A.T.A. method and assuming 600 hr. utilization and 1,500 naut. mile stage-length, at 26.4 U.S. cents per aircraft-mile.

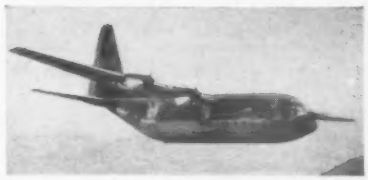
Some basic data for the twin-Orpheus version follow: Span, 53 ft. 8 in.; gross wing area, 523 sq. ft.; overall length, 58 ft. 10 in.; basic operational weight, 15,139 lb.; max. payload, 4,000 lb.; normal gross weight 29,333 lb.; max. zero fuel weight, 18,333 lb.; max. gross weight (1,066 Imp. gallons in slipper tanks), 38,841 lb.; max. landing weight, 26,000 lb.; optimum cruising speed, 442 knots T.A.S. at 15,000 ft.; max. range with internal fuel (1,970 Imp. gal.) inc. 30 min. reserve and 5% tolerance, 1,500 naut. miles; max. range with max. fuel, 2,500 naut. miles.

Lockheed 282A, Hercules

DETAILED studies have been made by Lockheed of the commercial application of their C-130 Hercules military freighter, and the company is now in a position to offer this type for civil use in 1960. The project is based upon the newest C-130B variant with greater gross weight and more powerful engines; commercial design studies have been made for weights up to 150,000 lb. The engines would be Allison 501D-22s, equivalent to the military T56-A-7A rated at 4,050 e.h.p. for take-off.

The Hercules has a cabin volume of 4,300 cu. ft. measuring 41 ft. by 10 ft. by 9 ft. Provision is made for rear loading. Brief data follow:

Span, 132 ft. 7 in.; length, 97 ft. 8 in.; operating weight, empty, 69,300 lb., max. payload, 47,400 lb.; gross weight, 135,000 lb.; landing weight, 121,600 lb.; max. zero fuel weight, 114,600 lb.; cruising speed, 282



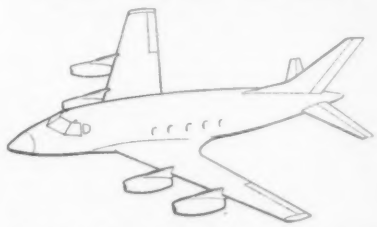
knots at 80% power; range with max. fuel (5,745 Imp. gal.), 2,700 naut. miles with 36,500 lb. payload; range with max. payload (including 7,000 lb. fuel reserve), 1,860 naut. miles.

McDonnel 119

McDONNEL AIRCRAFT are constructing a prototype of their Model 119 utility jet transport to compete with the Lockheed Jetstar for a U.S.A.F. contract. If put into production, the 119 would also be available for executive and feeder-line use. The layout is orthodox by U.S. standards, with a low wing and four podded engines—either General Electric J85 or Fairchild J83, both rated at 2,000 lb.s.t. for take-off.

In the 685-cu.-ft. cabin, the 119 would normally seat 10 passengers, with up to 17 in high-density arrangements, or 9,000 lb. of freight. Normal fuel capacity in integral wing tanks is 1,300 Imp. gal., with provision for 510 gal. in a centre-section tank and up to 915 gal. externally under the fuselage.

Preliminary data for the McDonnel 119

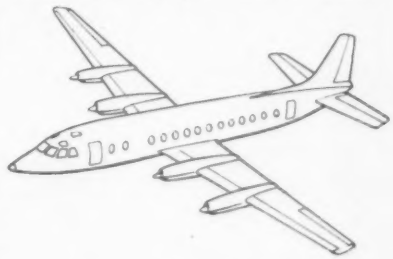


with J85s are as follow: Span, 57 ft.; wing area, 550 sq. ft.; length, 66 ft.; gross weight, 33,750 lb.; range with normal fuel (30 min. reserve), 1,500 naut. miles; range with max. fuel (30 min. reserve), 2,200 naut. miles; cruising speed Mach=.73-.79.

Republic Rainbow

REPUBLIC AVIATION have been conducting market research since the end of 1957 into transport aircraft in the medium-range category. A questionnaire has been circulated widely in the airline industry and this included details of an aircraft called the Rainbow as a basis to be used in answering the questions.

Although more than a pencil sketch, the Rainbow is not at present a serious design study and if Republic proceed with an aircraft in this category it would presumably



include changes in the light of the survey. As presented to the airlines the Rainbow was a four-engined 77,500-lb. gross weight design, with maximum accommodation for 80 passengers and powered by four 2,600 e.h.p. Dart R.Da.10s or General Electric T64s. Emphasis was placed upon good field performance, using leading-edge slats; balanced take-off distance required at max. weight would be 3,160 ft. (I.S.A. at sea-level) and C.A.R. landing field length at 74,000 lb. would be 4,000 ft.

Commercial Aircraft . . . .

Breguet 941

THE Breguet 940 Intégral, which began its flight trials in France on May 21, 1958, is in effect a flying-scale model for a much larger transport project designated the Br. 941. This has been designed for either high-density inter-city passenger transport, or various military rôles. Both aircraft are of the STOL type, deriving this characteristic from the use of large, slow-running propellers in combination with large-area, camber-changing and slotted flaps.

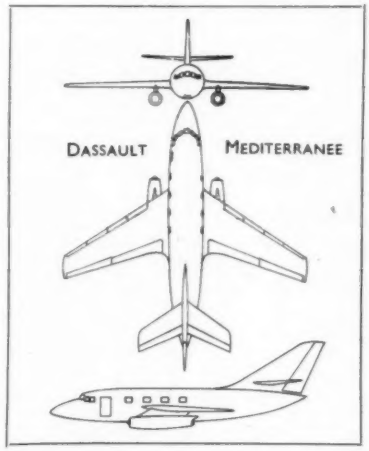
At 32,500 lb. for STOL operations the Br. 941 has just twice the gross weight of the Br. 940 and is to be powered by four 1,100 e.h.p. Turboméca Turmo III turboprops, or equivalent U.S. or British engines. At this weight, the Br. 941 will have a payload of 12,100 lb. and will take off and land, over a 50 ft. obstacle, in less than 650 ft.

Cruising speed at 10,000 ft. will be 215-245 knots and principal dimensions are: span 77.5 ft.; length 79.3 ft., wing area 898 sq. ft.; freight hold length, 30.8 ft.; width 8.13 ft.; height, 8.54 ft.; and volume, 2,110 cu. ft.

Dassault Méditerranée

THE privately owned French company of Marcel Dassault has announced its intention of constructing a small executive twin-jet, the Méditerranée, shown in the accompanying general arrangement drawing. In a similar class to the Lockheed Jetstar, the Méditerranée is being produced with the France-North Africa sectors particularly in mind, it being Dassault's slogan to "reach the Sahara in three hours from Paris."

The Méditerranée is the work of the company's design bureau at Talence, responsible also for the MD315 Flamant and, more recently, the Etendard fighter. The wing has 30° sweepback at 25% M.A.C. and is unusually located in the mid-position, apparently with no centre section. Dassault propose to use two of their own R-7 Farandole turbojets, which are enlarged developments of the Armstrong Siddeley Viper, rated at 3,000 lb.s.t. each for take-off.

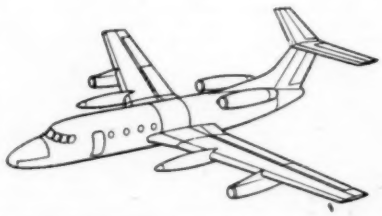


The Méditerranée will accommodate 6-8 passengers, two abreast in the cabin, which is 11 ft. 10 in. long and has an internal diameter of 63 in.

Among the few available details of the Méditerranée are the following: span, 46 ft. 3 in.; length, 51 ft. 10 in.; gross weight, 20,280 lb.; and cruising speed, 485 knots.

Morane Saulnier M.S.880

THIS privately owned French manufacturer has been studying various types of small jet transport, of which the latest is the M.S.880. This project has superseded the M.S.785 Comté de Nice, shown as a model at the 1957 Paris Salon, which was a 20-36 seat executive to the classic American formula with four podded Turboméca Gabizo turbojets of 2,425 lb. thrust each.



The M.S.880 is also planned as an executive, seating eight passengers, and has its four Gabizo engines unusually disposed two in wing pods and two in rear fuselage nacelles. Characteristics include a gross weight of 31,300 lb., and a range of 2,175 miles cruising at 486 knots at 36,000 ft. There are no plans at present to build a prototype.

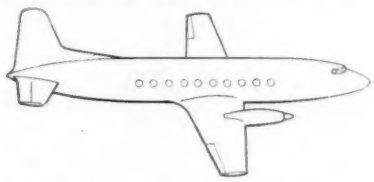
Hamburg HFB 209

HAMBURGER FLUGZEUGBAU have joined with the Spanish CASA company in the development of the HFB 209 or Super Azor (see page 35). This project is an enlarged version of the CASA 207 Azor, powered by two Napier Eland turboprops, with the Allison 501D-13 and Rolls-Royce Tyne specified as alternatives. The HFB 209 would seat 48 passengers, with a high-density layout for 54, in both cases with four-abreast seating. Operating cost has been estimated at 16-18 U.S. cents/ton-nautical mile for stage lengths up to 900 naut. miles, assuming 3,000 hr. annual utilization.

Basic data for the HFB 209 are as follow: Span, 93 ft. 8 in.; length, 76 ft. 6 in.; basic operational weight, 25,840 lb.; mfrs. max. payload, 11,800 lb.; gross weight, 45,080 lb.; cruising speed, 276 knots at 20,000 ft.; balanced field length, 3,880 ft.; range with max. fuel (1,170 Imp. gal.), with reserves for ¼ hr. and 200 naut. miles, 1,025 naut. miles; and range with max. payload, 650 naut. miles.

Japanese Turboprop

DEVELOPMENT of a medium-range turboprop transport is being sponsored in Japan by the Ministry of International Trade and Industry, which has made a preliminary grant of $330,000 to cover initial design work. The project is reported to be a joint venture by six major manufacturers—Shin Mitsubishi, Kawasaki, Fuji, Shin Meiwa, Showa and Nippon. The requirement is for a 40-60-passenger twin-engined aircraft weighing about 40,000 lb. and cruising at 320 m.p.h. for 1,000 miles. Two Rolls-Royce Darts will probably be used and these may be built in Japan.



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CORRESPONDENCE

Compromise Convexity?

GRANTED that the pressure differential is only about 9 p.s.i., it is, however, interesting to note that the domed forward pressure bulkhead in the Valiant (THE AEROPLANE, May 16) is convex to the load which is contrary to normal "ground-borne" pressure-vessel practice. This has apparently required some heavy and complicated ribs and pressings to achieve strength and some degree of concavity; the segments being dished forward.

One could presume that this arrangement has been the result of an argument between those who wanted to put equipment forward of the bulkhead and those concerned with leg-room for the crew.

London, N.W.2. "L.F.E.C."

An Autogiro Revival?

HOW pleasant to read the lines in your editorial "We are surprised that nobody has resuscitated the Autogiro. . . ." (THE AEROPLANE, May 9, 1958.)

In the early thirties I was associated with the late Señor Don Juan de la Cierva on the design and production of the C.30 and later types of Autogiro. I would like to see an up-to-date Autogiro in production which would fill the gap left when production of Autogiros ceased.

It may interest the happy band of the Cierva "Bush House" and "Hanworth" days to know that Otto Reder is a director of a helicopter firm in Stuttgart and sends his kind regards to his "Autogiro" friends.

Southampton. C. E. A. SAMUEL-CAMPS.

The Discovery of Tangmere

IN Press reports of the closing of Tangmere it was stated that I discovered Tangmere in a forced landing in 1917. That was stated in the Air Ministry hand-out.

So for the benefit of future historians who may also cull their history from ancient Press files, let's get this straight before it's too late. My first landing at Tangmere was in 1916 *not* 1917, November 19 to be quite accurate.

London, S.W.5. GEOFFREY DORMAN.

Paper Aeroplanes

WOULD your readers care to comment on the following "paper" aircraft?

First, a "cheap" version of the Vanguard aimed solely at the 600-mile-range case and, of course, below 600 miles. A shorter span, for lower-altitude cruising, with possibly a slight reduction in fuselage length to save weight, lower pressure difference would be required and simpler facilities all round. No attempt would be made to achieve a high cruising speed, although some use might be made of high-lift devices, or wing modifications to the same effect.

The net result would be a much lower gross take-off weight but, of course, landing weight would not be altered in proportion. However, 90,000 lb. a.u.w. or less would appear to be the result. Thus, to achieve an adequate (remembering the maximum range) cruising speed, the lower-weight Eland engine could be used, say an N.El.4 derated to 3,500 e.h.p.

All the services would be designed for maximum speed of turn-round to the last detail. The result would be a 100-passenger cum freighter on the same principle as the Vanguard 950, but having a maximum designed tankage allowing only a 600-mile stage, and no more.

Obviously the whole aircraft would be of somewhat lighter and simpler structure and control than the present Vanguard. Thus it would also be considerably cheaper, particularly in respect of its engines. It would be ideally suited to the American market since its total payload could be carried in passengers and their baggage.

Secondly, a Britannia development making use of control of the boundary layer through a pair of RB.108 engines buried in the wing.

The payload and range would have to be greater than the American big jets with equal passenger capacity. If the Russians can achieve 560 m.p.h. with a turboprop, surely we can do the same. If this can in fact be done the speed advantage of the American aircraft does not appear so formidable. It is fairly certain that 600 m.p.h. is *not* the most economical speed for crossing the Atlantic.

Provided the speed advantage can be sufficiently narrowed, the greater regularity and lower first cost of a turboprop machine of 2/3 the weight of the jets, and its greater economy, would make a somewhat lower load factor permissible.

The greater flexibility of the turboprop, shorter turnround owing to less fuel, etc., and lower runway requirements are a permanent advantage, of course.

I may be quite wrong, but either of these "paper" aircraft seems to me to offer bigger profits than the aircraft soon to come into service. In the first case, since the Vanguard will not now achieve its original aim of forming a "one-model fleet" for any airline, it seems to hold more particularly.

Ilkley. J. P. HARRISON.

Groundabout

Barge at Large. Normalair people at Yeovil will tell you that life in an airfield office can be very interesting. A little while ago some Naval brass arrived there in their Sea Prince, or Admiral's Barge, to see a demonstration of Westland's Wessex. Afterwards, the Barge's skipper went aboard to start up and told the ground crew to take away the chocks. He'd hold it on the brakes. Regrettably, he then found that brakes and chocks had he none but he did have a nice slope leading to Normalair's new building. The Prince entered through a ground floor window as the staff left by the opposite doors. Failing an anchor, surely there was a boat-hook aboard?

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"Long hair, button undone and a *dreadful* knot in your tie—take this man's number!"

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"Engineersmanship." Under this title a delightful booklet has been put out by the Benson-Lehner Corpn., of Los Angeles, whose data-processing equipment is being used for the Blackburn N.A.39. Bernard Benson, their president, is English, ex-R.A.F. pilot, ex-R.A.E., he initiated and directed early work on acoustic homing torpedoes and guided missiles, went to U.S.A., worked on Douglas's Nike missile, then set up his successful company in 1950. He wrote this crisp, cartoon-illustrated booklet which, under such headings as "Be Hard To Get," and "Avoid Positive Statements," gives sound advice: "Never be caught with your mock-up down. . . . Only people like accountants take schedules seriously. . . . Beware of being ahead of your time—look at Leonardo da Vinci—all his stuff ended up in a museum." For a copy, write to Benson-Lehner (GB), Ltd., 12 Bargate, Southampton.

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Korean Kopter. Talking of rotor-wings, our American photographic friend, Howard Levy, has sent us news of another "do-it-yourself" job, the Ho 1, built by a Korean mechanic, Cho Dong Ho. With virtually no resources or education, Mr. Ho has constructed a contra-rotating-rotor job, with a flat-twin engine. To restore some of the confidence of our own highly educated helicopter people, with their *unlimited* resources, I should point out that Ho 1 has not yet flown.

by Lorenzo

News About People

DISPLAY IN THE WEST.—Air Cdre. Sir Frank Whittle, K.B.E., opening the R.A.F.A. display at Exeter Airport on June 28. With him (left) is Wg. Cdr. R. J. B. Pearse, airport manager.

BLACKBURN DIRECTOR. — Mr. A. F. Jopling, A.C.A., a director of Blackburn and General Aircraft, Ltd., has been appointed a director of Blackburn (Dumbarton), Ltd., and of Thomas Green and Son, Ltd., of Leeds.

GLIDING RESULTS.—As we go to press the final results of the World Gliding Championships are published:—

Open Class.—1, E. Haase (W. Germany), 5,651; 2, Cdr. N. Goodhart (Great Britain), 5,172; 3, R. Mestan (Czechoslovakia), 5,124; 4, B. Komac (Yugoslavia), 5,118; 5, E. Makula (Poland), 5,066; 6, D. Barbera (France), 4,997; 7, Lt.-Col. A. Deane-Drummond (Great Britain), 4,924.

Standard Class.—1 A. Witek (Poland), 5,232; 2, P. Persson (Sweden), 5,086; 3, H. Huth (W. Germany), 5,021; 4, J. Horma (Finland), 4,844; 5, H. Tandefeld (Finland), 4,673; 6, J. Wojnar (Poland), 4,553; 7, Cdr. A. Goodhart (Great Britain), 4,427. P. Wills (Great Britain), 3,379, was 13th.

AIR CORRESPONDENT. — Mr. Reginald Turnill has been appointed the B.B.C.'s air correspondent and replaces Mr. Ivor Jones, who is now Berlin correspondent. Mr. Turnill was formerly assistant industrial correspondent.

A PAKISTAN LOSS.—Pakistan's leading pilot, Sqn. Ldr. Khalid Khan, younger brother of A.V.M. M. Asghar Khan, C.-in-C. of the P.A.F., has been killed in an accident at Peshawar. He was trained at R.A.F. Cranwell.

BRISTOL SIDDELEY ENGINES.—Sir Mark Norman, Bt., 31, has been appointed secretary of Bristol Siddeley Engines, Ltd., the company formed recently by Bristol Aero-Engines, Ltd., and Armstrong Siddeley Motors, Ltd. He will be responsible to the board, under the chairmanship of Sir Arnold Hall, for the detail administration and co-ordination of the company's activities. London office of the company is at Ormonde House, 26-27 St. James's Street, S.W.1. Sir Mark is the eldest son of Air Cdre. Sir Nigel Norman. Since 1956 he has been with Bristol Aircraft's sales department, and was formerly with Airwork, Ltd. For four years he was a member of No. 601 Sqn., R.Aux.A.F.

Sir Mark Norman, Bt., the newly appointed secretary of Bristol Siddeley.

Aviation Calendar

July 5.—NATO Air Display at **Soesterberg,** Holland, at 15.00 hrs.

July 5-6.—12th Rally of the Wines and Chateaux, organized by Aéro-Club de l'Ouest at **Anjou,** France.

July 5-7.—R.Ae.C. Invitation Air Rally, at **Deauville,** Calvados, France.

July 8-11.—Institute of the Aeronautical Sciences, National Summer Meeting at **Los Angeles,** California.

July 10-12. — National Air Races and British Lockheed International Aerobatic Competition, organized by the R.Ae.C., at **Baginton,** Coventry.

July 13.—Wolverhampton Aero Club "At Home," at **Wolverhampton Airport.**

July 13.—Leicestershire Aero Club "At Home," at **Leicester East Aerodrome.**

July 16. — Kronfeld Club talk, "The London Gliding Club," by Dudley Hiscox, at 74 Eccleston Square, **London, S.W.1,** at 20.00 hrs.

July 19.—R.N.A.S. **Eglinton** "At Home."

July 19.—R.N.A.S. **Culdrose** "At Home."

July 19.—"At Home" organized by the **Lasham Gliding Centre.**

July 19-20.—Caen Rally organized by the Calvados Aero Club, **France.**

July 20.—Air Display organized by the Fair Oaks Aero Club, at **Fair Oaks Aerodrome,** Surrey.

July 26. — R.N.A.S. **Lossiemouth** "At Home."

July 26-27.—Tour of the Dolomites arranged by the Trente and Bolzano Aero Clubs, **Italy.**

July 26-August 4.—National Soaring Week organized by the B.G.A.

August 1-16.—World Parachute Championships organized by the Czech Aero Club at **Bratislava,** Czechoslovakia.

August 2. — R.N.A.S. **Brawdy** "At Home."

August 2-4.—Rally organized by the Plymouth Aero Club, at **Plymouth Airport.**

MR. W. ENYART.—It is with great regret that we record that Mr. William Enyart was among those who lost their lives in the Stratotanker crash in the United States last week. Mr. Enyart, who was president of the National Aeronautics Association, a past-president of the F.A.I., and an Associate Fellow of the I.A.S., had many friends in this country. He will be remembered particularly by a large number of the British delegates to the R.Ae.S.-I.A.S. Anglo-American Conferences on both sides of the Atlantic.

NOTES AND EVENTS

FOR RELAY CENTRES.—International Aeradio last week demonstrated their new push-button torn-tape relay centre equipment, Type 1A301. The equipment, which we will describe in a later issue, is intended for use at small telecommunications centres, where an automatic relay system is not justified.

U.K. REPRESENTATIVE. — Aerocontacts (Sales), Ltd., of Gatwick Airport, has been appointed as the exclusive United Kingdom representative of the Leach Corpn. of America for that company's range of electrical relays, which are incorporated in many American aircraft and have missile applications.

LONDON TO LUTON.—The Napier 150th anniversary exhibition held recently in London is being transferred to Luton. It will be open to the public from July 1-12 in the hall of the Industrial College, Chapel Street.

CREDIT WHERE DUE.—Acknowledgment of the sources of the micrograph photographs used to illustrate Professor Kennedy's article in our June 20 issue was inadvertently omitted. These photographs and their authors were: Slip-band extrusion, by P. J. E. Forsyth (Proc. Roy. Soc.); nickel fatigue, by G. C. Smith (Proc. Roy. Soc.); lithium fluoride dislocations, by J. J. Gilman (*Journal of Applied Physics*); silicon iron dislocations, by J. C. Suits and J. R. Low (*Acta Metallurgica*); and precipitation in Duralumin, by D. Kuhimann-Wilsdorf (*Philosophical Magazine*).

MAGNESIUM SPECIALISTS.—There are few British aircraft flying today which do not incorporate magnesium-alloy castings produced by Sterling Metals, Ltd. This company can claim the distinction of being the largest supplier in the country of castings in magnesium-zirconium and magnesium-zirconium-thorium alloys. Their name should, of course, have been included in the directory section of our June 20 special issue on Materials and Processes, but owing to an oversight it was omitted.

THRUXTON FOR SALE. — In Andover on July 7, at 14.30 hrs., Thruxton is to be auctioned as a civil aerodrome by Strutt and Parker, Lofts and Warner of 41 Berkeley Square, London, W.1.

E.M.I. DEVELOPMENT. — E.M.I. Electronics, Ltd., in collaboration with the Cincinnati Milling Machine Co. of the U.S.A., has developed a data control system suitable for use with large skin-milling machines. The first system for a machine of this type has been built at the company's Hayes factory and is eventually to be delivered to the U.S.A.F. Air Materiel Command. Four systems have been completed to date and further orders have been received.

Birth Notices

Beacham.—On June 11, at Louth, to Mary (*née* Kirby), wife of Flt. Lt. W. J. Beacham—a daughter.

Browne.—On June 16, at Savernake Cottage Hospital, Wilts, to Mary, wife of Flt. Lt. D. Browne, M.B.—a daughter.

Chambers.—On June 16, to Jean, wife of Flt. Lt. I. I. Chambers, D.F.C.—a daughter.

Courtnage.—On June 21, at R.A.F. Hospital, Halton, to Phyllis (*née* Gamblin), wife of Sqn. Ldr. K. Courtnage—a son.

Gosnell.—On June 11, at R.A.F. Hospital, Halton, to Patricia (*née* Lees), wife of Gp. Capt. R. J. Gosnell—a son.

Meader.—On June 17, to Ann (*née* Turk), wife of Flg. Off. J. C. Meader—a daughter.

Woods.—On June 22, at Louise Margaret Hospital, Aldershot, to Nancy (*née* Caldecott), wife of Sqn. Ldr. J. J. Woods—a son.